THE IRON TRADE REVIEW

VOLUME XXVIII. CLEVELAND, O. MARCH 14, 1895. CHICAGO, ILL. NUMBER 11.

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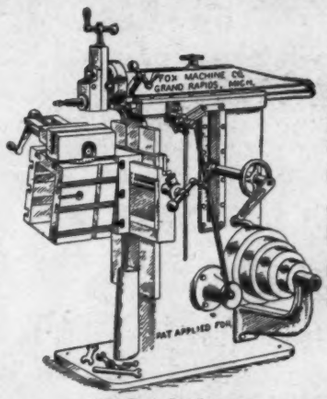

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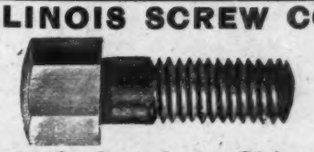

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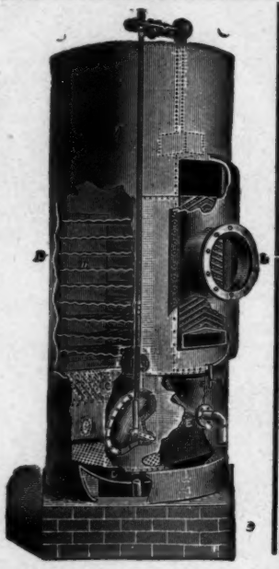

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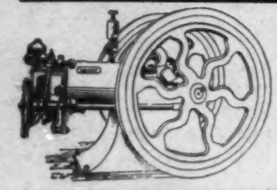

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THE IRON TRADE REVIEW

VOLUME XXVIII. CLEVELAND, O. MARCH 14, 1895. CHICAGO, ILL. NUMBER 11.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Putting together the reports from various pig iron selling centers, there has been an encouraging activity in that metal in the past ten days. Bessemer pig has seen a lull, but in foundry and mill grades there has been an increasing sale. Southern furnaces have had a good share of the going business, but without any improvement in prices. In Eastern Pennsylvania and in the New York market larger sales of Alabama iron have been attended with further cuts. Detroit has had larger purchases of pig iron in the week than for many weeks preceding. There is a better feeling as the result of the railroad purchases, the car orders having given business to a variety of industries that are not directly affected by rail purchases. Western lines have contributed more, of late, to the volume of railroad buying, particularly in cars, but it is well understood that some carriers in that section —especially the corn roads—must have a good crop to haul before they can be of great help to the iron market. Reports from the foundries are rather conflicting. Some sellers of pig iron find their foundry trade still disposed to follow the market closely; in the East and New England foundry work has not come up in sufficient volume to prompt any change in this policy. Eastern pipe works are, perhaps, an exception, but the contracts they have taken recently against Southern competition do not measure up to the exceptional tonnage closed by municipalities at this time last year. In the Chicago district there is some improvement among foundries in the amount of business, though complaint is heard of the disposition of certain firms to make prices without reference to cost. The Pittsburg market has shown practically no change in the week, either as to volume or prices. The weakness in billets is still a prominent feature, though little has been done on the $14.75 basis. Bessemer pig has shown little activity, outside of a 10,000-ton sale for May delivery in the district tributary to Cleveland. It is understood to be at a figure equivalent to $9.60 at valley furnace, and that is the price maintained today by valley makers. A contagious uneasiness has been noticed in the coke region, since the strike of Pittsburg district miners, but there is no development yet that would fix the price after April 1. Some contracts are said to have been made for April and May, with the stipulation that the price shall advance 3 cents a ton for every cent advance per hundred bushels that may be made to the miners. The advance in freights on bituminous coal in Ohio means higher fuel costs to all consumers of coal from those districts, and the indications are that the extremely low fuel basis in all industries is about at an end. On April 1 the summer rates on iron articles go into effect, or two months later than last year. On less than carloads, however, the present rate is maintained. Pig iron production today is at a less rate than in January and February, and there is satisfaction in the fact that the rate of accumulation in the hands of makers has been arrested by the past month's purchases North and South.

THE CLEVELAND OUTLOOK.

The iron ore situation is still a waiting one. In the Lake Superior region, managers of active mines are slowly adding to their stockpiles, but there is no movement for resumption at idle properties, and the general policy is very conservative. It would appear that with the scattering of miners to other localities that has been going on in the year, there is little probability of such a scale of operations at Bessemer producing mines on the old ranges this year as will put any severe strain on the arrangement for restricting output. A straw as to the attitude of the furnace interest toward Mesabi ore is found in the changes now being made in one of an important group of furnaces in the Pittsburg district. The bosh will be narrowed from 22 feet to 18 feet and the hearth widened to 13 feet, bringing the melting zone lower in the furnace, lessening the tendency to hang, and a higher blast pressure will be employed. The interest of the company in question in one of the Mesabi mines accounts for this effort to set a pace in modifying furnace practice.

Pig Iron. Valley furnaces appear to have held quite generally in the past 10 days to $9.60 at furnace for Bessemer pig, equivalent to $10.25 Pittsburg, and one sale is reported at $9.65. A sale of 10,000 tons for shipment into the Cleveland district was closed at a figure reported as equivalent to $9.60 in the valley. Within the past few days an offer of $9.45, valley furnace, has been made by a Pittsburg interest, on iron for May shipment, but it has gone thus far untaken. The coke output continues heavy, and the Connellsville record of nearly 160,000 tons in the first week of March, was not equaled in any week in 1893 or 1894. Furnaces have been taking heavy shipments, under low-rate contracts now in force and to expire in a fortnight. Speculation as to the price of coke after April 1 has little to direct it except the probability that for every cent advance in the mining rate per 100 bushels, about three cents will be added to the market price, to cover proportionate advances to other kinds of labor. The past week has seen exceedingly light sales of foundry iron from the valleys. Only one 500-ton sale is reported. On No. 2, $9.25 is quoted and $9.85 on No. 1 at furnace, but these figures are shaded and $9 sales of No. 2 are reported, with some cuts even below that figure.

Finished Material. A better inquiry for steel mill products is noted in the Cleveland district, and the current output of mills represented in Cleveland is larger than for some time. A Canton contract for 200 tons of plates and machinery steel was taken by Pittsburg, against sharp competition. At Toledo a bridge contract calling for 1,500 tons of material is to be let the coming week. Other bridge work has furnished some business in the week under review. On beams and channels, while here and there a cut has been made, prices have generally held to the basis heretofore quoted with, 1.20c Pittsburg as a minimum. Bar mills in the valley are firmer in their ideas on small-lot orders, but the recent large contracts were at bottom figures. Scrap is costing the mills more money. Several lines of railroad scrap have been sold the past week to dealers at $8.75 and have been resold by them at the customary margin.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

The feeling among the trade in this territory seems to be growing better among buyers and sellers of nearly all classes of iron and steel. Buying last week was not much larger than it was the week before, but the orders come from more widely scattered points than has been the case for some time past. This is particularly the case with raw material, for which a great many small orders, well scattered, have been received. In finished material a fairly good business is being done, and it seems to be growing larger every week. The outlook is excellent for a good business in all branches of the iron and steel trade, and it is likely that the next few weeks will see an increasing volume of buying.

PIG IRON.—The market is in better condition than for some time, the good feeling noted last week being even more noticeable. Orders come from buyers who have not been in the market for some time—in small lots, it is true, but the fact of such buying is cause for hope. Founders as a rule report a better business than they have been having, and are inclined to the belief that their trade is improving slowly, but surely. This is true of nearly all classes of founders except stove makers, who are now in the middle of their slack season. Agricultural and machinery men find a better demand with prospects of further improvement. Local iron sold in only small lots last week, but the number of orders received brought the total tonnage up to the average of the past three or four weeks, and possibly exceeded it. One order of 1,000 tons was taken, but aside from this nothing larger than 400 tons was secured. Prices are being held firmly and no charges of cutting are heard. Southern iron also did quite well last week. The largest order taken was for 400 tons, and from that down. The aggregate was fully as large as the previous week, and the orders came from a wider territory than has been the rule lately. All furnaces report receiving orders to ship on contracts as fast as they can, and at least one of the local furnaces is a little behind on shipments. There are several good orders in sight for both Northern and Southern iron, and it is likely that these will be closed up in the near future. Lake Superior charcoal iron has not sold in large quantities in the past week, but one inquiry for 500 tons is reported. Quotations on all classes of pig iron are unchanged, as follows:

Lake Sup. Charcoal	$13 00@13 50	Southern No. 2 Soft	$ 9 75@10 00
Local Coke Fdy. No. 1	10 25@10 50	South'n Silveries No. 1	11 50@11 75
Local Coke Fdy. No. 2	9 75@10 00	South'n Silveries No. 2	11 25@11 50
Local Coke Fdy. No. 3	9 40@ 9 65	Jackson Co. Silveries	15 00@16 00
Local Scotch Fdy. No. 1	10 25@10 50	Ohio Silveries No. 1	14 00@14 50
Local Scotch Fdy. No. 2	9 75@10 00	Ohio Silveries No. 2	13 00@13 50
Local Scotch Fdy. No. 3	9 50@ 9 75	Ohio Strong Softeners	12 50@13 00
South'n Coke No. 2	10 00@10 25	Alabama Car Wheel	17 50@18 00
South'n Coke No. 3	9 50@ 9 75	Malleable Bessemer	11 00@11 50
Southern No. 1 Soft	10 00@10 25	Coke Bessemer	11 00@11 50

BARS.—The week has been rather quiet, only one order of any size being reported, from car works, for 500 tons. General business is good and appears to be increasing all the time, and a feature of the market is that orders and inquiries are being received for good sized lots from concerns that have not been in the market lately. There are several good inquiries in the market now, and it is likely that some of them will soon develop into orders. The element of strength noted last week has increased, as all of the valley mills are now holding to 1.05c for common iron. Some of the near-by mills are also holding out for a figure near this. Iron is still being sold at 1c, but it seems likely that the mills that are selling at this price will be able to get better prices in the near future. Bar steel from strictly billet stock is quoted at 1.20c, and guaranteed iron at 1.15c.

RAILS AND TRACK SUPPLIES.—While sales in the past week were no larger than in the week before, the market is in a much better condition, as there have been received several large inquiries. The local mills report the tonnage closed this year as being fully equal to that of last year at this time, and express the belief that the record for the next few months will be better than that of last year. Quotations are maintained at $23 to $25 for rails; splice bars, 1.25c to 1.30c; track bolts, 1.95c to 2c; spikes, 1.65c. to 1.70c.

BILLETS AND RODS.—The market has been quiet in the past week, and no sales of either billets or rods have been made. Prices are as last quoted: Billets, $16.50; and rods, $23 to $23.50.

STRUCTURAL MATERIAL.—No large single orders were placed last week in this market, but the general business is growing, and it seems likely will reach a good volume within the next thirty days. An encouraging feature is the fact that orders are coming from some firms that have not been buying lately. Prices are unchanged. Beams and channels, 1.45c to 1.50c; angles, 1.30c to 1.35c; plates, 1.35c to 1.40c; tees, 1.65c to 1.70c. Small lots from stock are quoted at ¼c to ½c higher.

PLATES.—Inquiry is better, and some sales have been made. It is expected that the volume will increase as the spring weather becomes more pronounced. Quotations are unchanged, as follows: Tank steel, 1.35c to 1.40c; flange steel, 1.50c to 1.75c; firebox steel, 2c to 5c; boiler tubes, 75 to 77½ per cent discount.

MERCHANT STEEL.—There does not seem to be any pronounced improvement. Orders are received for only small lots. Prices are made as follows: Open-hearth spring, tire and machinery steel, 1.55c to 1.60c; smooth finished tire and machinery, 1.50c to 1.60c; Bessemer bars, 1.35c to 1.40c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

SHEETS.—Business keeps up well, and several good contracts were closed last week for future delivery, besides a good business done in immediate delivery. Inquiry is still large, and it is likely that the next few weeks will be good ones in this branch of the trade. Quotations are made at 2.25c to 2.30c for No. 27 common iron; steel sheets are sold at 2.35 to 2.40; galvanized sheets are a little weaker at 80 per cent discount.

OLD RAILS AND WHEELS.—Old iron rails are in fair demand, and some small sales were made last week. Old steel rails are quiet, with almost no business done. Old wheels are attracting some interest, and a little speculative buying is being done. Old iron rails, $10.50 to $11; old steel rails, $7 to $9, according to length; old wheels, $8.25 to $8.50.

SCRAP.—Cast scrap is in good demand, but stocks are small, and as a consequence small sales are being made. Sales of heavy melting steel scrap were large last week. Railroad forge is also in good demand. Prices are made as follows: Railroad forge, $8.50 to $9; dealer's forge, $7; No. 1 mill, $6 50; No. 1 machinery, $7; axles, $12 to $12.25; cast borings, $3.50; wrought turnings, $5.25; axle turnings, $6.25; mixed steel, $5; heavy cast, $7 to $7.25; stove plates, $5 to $5.25; heavy melting steel, $7 to $7.50.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. There is a lull in the Bessemer pig market following the recent large buying. No transactions worthy of note are reported. One 500-ton sale was made at $9.65 valley furnace. While there are some inquiries for Bessemer, buyers are holding off; meantime quotations are maintained at $10.15@$10.25. The weaker

feeling in billets continues. A sale of 1,500 tons and another of 500 tons at $14.90 are reported, but this price is shaded, and $14.75 at mill has been done. In connection with local water works contracts, 9,000 tons of open-hearth plates are to be bought by the city this week. A considerable tonnage of skelp iron is being called for. On bar iron an advance to .95c for common is being maintained under buying on car account, and this demand has also strengthened the scrap market. Old rails have sold at $12.50 at Valley and Pittsburg mills and other old material is advancing. Coke for March shipment has sold at $1 the past week.

Buffalo. A moderate business is doing, each week having a considerable tonnage, but all with such deliberation and care as to take away any semblance of activity. Prices are figured to the finest points to induce trade, but there yet appears a well defined bottom below which sellers will not go. Lake Superior charcoal iron continues to be the only scarce kind in the Eastern market. High silicon irons are in slightly better demand.

Cincinnati. The trend of trade is gratifying, as the total of business has increased in a very general way, indicating greater activity in industrial enterprises in nearly every branch. The pipe works are enjoying a continuance of liberal orders, and the improved conditions of the railroads justify the expectation of their complete equipment with the rolling stock necessary for constantly augmenting traffic. Several prominent concerns have placed large pig iron orders during the week, feeling confident that the tide has turned, and the flow set in. As yet prices are unchanged,

St. Louis. The iron market has been unusually active the past week. Sales are running largely to carload orders, but they come in good numbers and are well distributed for all classes of iron. An occasional order of 100 to 500 tons of Southern iron is placed. The car builders are busy. Several shops have turned out a larger number of cars in the past two months than during the entire year of 1894.

Detroit. F. B. Stevens reports on the pig iron market as follows: The spring outlook in this market is more favorable than we have been able to note for a long time. It has taken such substantial shape that orders were recently placed for 15,000 tons of Southern iron by two of the largest manufacturers. Small orders of no mean proportion have also been placed by manufacturers here, and in the representative cities of the State. The Michigan-Peninsular Car Co. has booked several orders, and the prospect of the immediate resumption of its large plant gives an encouraging look to all branches of business. It is not late enough yet to say what will be the demand for Lake Superior charcoal pig iron, although there is of course a local improvement, and judging from the condition of the localities tributary to this market and from the numerous inquiries, the opening of navigation will bring about a good demand for charcoal iron. The going price is $12.50 cash, f. o. b. cars Detroit, and a confident feeling prevails.

THE directors of the San Francisco & San Joaquin Valley railway have decided to begin the construction of the road without delay. They advertise for bids for 10,000 tons of steel rails, the first lot of the 2,000 tons to be shipped within 30 days of acceptance of the bid. It is estimated that 33,000 tons will be required to build the line as contemplated. About $3,000,000 has been subscribed to this enterprise by California capitalists.

THE Penn Bridge Co. has a contract for a $100,000 bridge over the Youghiogheny river at McKeesport, Pa.

SCIENCE IN THE FOUNDRY.

In the March number of the Journal of the Franklin Institute, Alex. E. Outerbridge directs attention to the prediction he made in a paper written in 1882, that pig iron would in time be sold on chemical analysis and that a new era was dawning in metallurgical science as applied to foundry practice. The car-wheel foundry practice of today is cited in illustration of the change that has been made since 1882. In referring to this and to the recent contributions to the literature of foundry chemistry, Mr. Outerbridge writes as follows:

The "ideal" iron for car wheels is a metal having an extremely dark, "open-grained," or coarse fracture, in the body or "plate" of the wheel, and a pure white, fine-grained adamantine structure, on the "tread" extending to a depth of about half an inch beneath the surface, and merging gradually into the soft gray iron backing. According to the old nomenclature, such metal may be said to have a gray iron fracture, equivalent to "No. IX," with an artificial crystallization, or chilling quality, equal to "No. 6," or white iron. Formerly, this ideal quality of metal for car wheels was actually produced in this country, and there is no doubt that this essentially American industry was indebted to that fact for its origin contemporaneously with the birth of the railway system half a century ago.

The gradual dismantling of old-time cold blast charcoal iron furnaces, and the increasing difficulty of obtaining pig iron adapted to the manufacture of chilled wheels, compelled the makers of this product to investigate chemically the elements composing such metal, with the view of ascertaining definitely the cause of the special property of "chilling," which, for many years, was peculiar to pig iron made with charcoal fuel by a cold blast, and could not be successfully produced by any other method of manufacture. The entering wedge in this study was introduced about the year 1879, by Dr. Dudley, chemist to the Pennsylvania Railroad; and, shortly after this the writer was called upon to take up a similar work for a large establishment in Philadelphia, engaged since 1847 in the manufacture of chilled wheels.

Dr. Dudley generously imparted the facts which he had gathered in the midst of many other important lines of investigation, and the writer took up these threads and found interesting occupation, extending over a period of several years, in weaving them together.

Some of the practical results of this investigation were embodied in a paper entitled the "Genesis of a Car Wheel," read before the Chemical Section of the Franklin Institute, in 1883, and later, in the more popular form of a lecture at the same institution in 1888, on "Pig Iron: Including the Relation between its Physical Properties and its Chemical Constituents."

It is admitted that chemical investigation has not only saved the car wheel industry from extinction, but also that it has enabled the manufacturer to turn out product today, which is subject to far more severe scrutiny before passing into service, and to vastly greater shocks and strains in ordinary use than heretofore, and at a minimum price. Indeed, it may be said in passing, that not the least wonderful feature of this special business is the price at which chilled cast-iron car wheels of good quality are now sold.

Within a very few years the subject of "Chemistry in the Foundry" has run riot in the discussions of the foundrymen's associations and in the journals devoted to iron interests. A vast amount of "green fruit" has been put upon the market, much of which has already withered before ripening; but this is not an unusual experience, and in taking a broad view of the subject, one can observe that considerable progress has been made.

Scientific system is gradually superseding rule-of-thumb, or empirical, methods, in progressive foundries, and much of the old-time superstition, born of ignorance, is being eradicated. This is true, not only in regard to the metallurgy of pig iron for castings, but also in regard to methods of molding and other cognate branches of the founder's art.

A PARAGRAPH under the heading "Various Conditions of Cogs," in a recent issue of *The Iron Trade Review*, should have been credited to the Boston *Commercial-Bulletin*.

THE IRON TRADE REVIEW

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B. M. GARDNER, Associate Editor and Western Manager.

ENTERED AT THE POST OFFICE IN CLEVELAND, O., AS SECOND CLASSMATTER.

MARCH 14, 1895.

THE decision of the directors of the San Francisco & San Joaquin Valley railway to begin construction work and their request for bids on 10,000 tons of rails for early delivery, with 20,000 tons likely to be needed later, will afford a new opportunity to compare prices of home-made and foreign-made rails delivered on the Pacific coast. English rails can be put on board ship for $17.00. Add freight and $7.84 duty and we have the figure which Western rail mills must meet to capture the business. It will be remembered that the last important contract on the Pacific Coast was taken by foreign mills, and that territory has been considered scarcely debatable by the mills of the United States. The Colorado mill, however, is better able to compete than at any time in its history. The cost of making Bessemer pig at Pueblo is now close to the basis of the Chicago district, and at that figure rails at Colorado mill can be made with to-day's low wages, within $2 of the English cost at mill. It is practically a case of rail freights to the Pacific Coast, against a $7.84 tariff. The trans-continental lines, it would seem, have the ability to keep this California rail business at home.

COMMENTING on the possibilities of shipments of Southern iron abroad, Mr. James Bowron, treasurer of the Tennessee Coal, Iron & Railroad Co. says: "To Mobile or Pensacola we can go for foreign shipment at $1 per ton, and are endeavoring to secure ballastings on cotton cargoes, and if we can do so we will certainly give some of the English consumers in the Manchester district the opportunity of comparing our iron with Cleveland district pig." One advantage the Southern iron will have, other things being equal, is its superior quality.

THE new iron freights that go into effect April 1, by decision of the general managers of Central Traffic Association lines are the usual summer schedules, iron products now shipped as fifth class dropping to sixth class. There is this difference from the procedure heretofore, however: on less than car loads the present rate will still be maintained. Coincidently with the change to sixth class rates, a new classification of iron articles is adopted, the effort being to prevent the shipment of highly finished articles under a classification properly pertaining only to articles nearer the raw state. The expectation is that the new arrangement will prevent some of the promiscuous cutting of rates that has been going on under the old classification through a growing looseness respecting class lines. One feature of the new classification about which much complaint has been made is putting sheet bars, tin plate bars and wire rods on the same basis as manufactured iron. To meet this objection, and at the same time prevent chain iron and other material which takes manufactured iron rates, from getting into the billet class, lists have been prepared of all points from which and to which sheet and tin plate bars and wire rods are shipped—that is, all points at which steel mills, sheet mills, tin plate mills, rod mills and wire nail mills are located. Between these points the articles named will take lower class rates.

PRESIDENT ROBERTS, of the Pennsylvania Co., always careful in his statements, is inclined to take a hopeful view of the future. In his address to the Pennsylvania's shareholders, this week, in referring to the severity of the late depression on the iron and mining industries, which contribute most of the Pennsylvania Co.'s business, he added: "But wherever the depression is most severe the rebound is most generous and we may trust that the time is not far distant when the business of your company will be better than ever before." To the same effect is the comment of our conservative contemporary, the *Railroad Gazette*, on the reduction of $10,000,000 last year from the Pennsylvania Co.'s expenditures for 1893:

> This great cutting down of expenses for the year shows what can be done by the most careful management, with a property which is in splendid condition, without injuring its efficiency. New construction has of course been kept at its lowest point. It is to be noted that this curtailment of operating expenses cannot continue indefinitely, and this fact contains the great element of promise for revival of trade in the present year. For as soon as financial conditions look a little better, the companies must begin to make the improvements and renewals which have been kept waiting, and the large amount of money to be spent in this way will be an immense stimulus to all industries.

ELECTRIC MOTORS IN MACHINE SHOPS.

The paper of Mr. George Richmond, before the American Society of Mechanical Engineers, Feb. 13, on "The Electric Motor in the Machine Shop," together with the discussion upon it, constitutes a valuable contribution to the rapidly growing literature on this subject. Prof. Crocker, of the Crocker-Wheeler Co., brought out these interesting points in the discussion:

> Those who install electric transmission in their factories cannot obtain exact figures, but will have to be guided by the practice of other shops where the conditions are similar. The exact efficiency or the actual amount of work done will not determine this point. I claim that the question, whether it is satisfactory in the long run and whether the superintendents and workmen like it, will best determine the success of this system. Figures are important, but many factors which you cannot put your finger upon must be considered. The greatest advantage is the fact that the shop is clear and the motive power is practically out of the way. I am sure that in very few, if any, shops are all the tools used any considerable fraction of the time. The average load year in and year out is about 30 per cent of the total capacity. Figures have been made, showing from 25 to 28 per cent. These may possibly be low. Mr. Richmond considers that the shop is running full most of the time. I believe that this is not so; in fact, where the running is light, the special advantage of electric power is most apparent.

Supplementing the discussion referred to above is this extract from a letter to Mr. Richmond, from Mr. Felix Melotte, who recently contributed a description of the electric installations at the Government Rifle Factory at Herstal, Belgium, to the *Revue Universelle des Mines:* It refers to the methods to be employed under varying circumstances:

> As to direct application of motors to machine tools I would not like to commit myself, not having had sufficiently long experience on this subject. My opinion up to the present is that

the heavy machine tools, which take one horse-power effective, could advantageously be operated by separate motors, but that when it is a question of small lathes or small milling machines, the case is not the same. We must distinguish between the case where the tools have to work intermittently and where they are constantly occupied; in fact, if it is desired to put a motor to every tool, it would be necessary to employ one-half horse-power motors, whose efficiency is very small. If we group three or four of these machines together they could be operated by quite a small countershaft driven by a motor of about two horse-power, from which can be obtained an efficiency of 70 to 75 per cent without paying excessively for it.

It is also necessary to judge of the probable time which the machines will work every day, and of the curve of efficiency, the different loads of the motor and of the transmission apparatus, before deciding in favor of one system over another. If for example you have four milling machines taking one-half horse-power each and you could be sure of keeping them all going during the day without stopping, you need not hesitate to work them by a two-horse power motor and a countershaft. But if it is one of those general machines which are necessary in all shops, such as drilling machines, emery wheels, drill grinding machines—in other words, tools which are only used from time to time—then I am convinced that a small motor with its wretched efficiency, even if it were as low as 40 per cent, would be preferable to no matter what system. They use no power except when they are running, and then yield 40 per cent, while if you are turning a countershaft when the tool is idle there is a loss of current, and at the end of the day your total efficiency will fall to 10 per cent, or even less.

New Hoisting Engines for the Mesabi Range.

Among the machinery plants being furnished for the Mesabi Range, are two special hoisting plants for handling heavy loads, put in by the Webster, Camp & Lane Machine Co., of Akron, O. The first has just been shipped to the Sellers Ore Co. for their mine at Hibbing, and consists of a pair of 15″x20″ Tangye frame engines with balanced double ported slide valves, geared to a pair of 60-ft. band friction hoisting drums, each having capacity for about 500 ft. of hoisting rope, and calculated to handle a load of 7,000 lbs. of ore, besides weight of skip and rope. The engines are so arranged as to work either with independent skips or to hoist in balance, being fitted with link reverse motion, the usual practice intended being to work them in balance.

The second plant is for the Adams Mining Co., and consists of a pair of 18″x24″ balanced slide-valve Tangye frame engines, geared to a very heavy pair of 6-ft. drums, to handle an unbalanced load of six tons of ore, besides weight of skip and rope. These engines are intended to work in balance exclusively, though an adjustment is provided in drums for taking up the stretch of rope and changing to different levels, if desired. These plants embody all the company's latest improvements in the way of appliances for rapid and economical hoisting, and are of especially heavy construction throughout.

JAMES B. CLOW & SON, of Chicago, whose pipe works at New Philadelphia, O., were destroyed by fire Feb. 28, have been negotiating with several towns that have made offers with a view to securing the new works that will be built at once. Dennison, O., has accepted the proposition of the companp, and has pledged $30,000 and a 20-acre site. The company are in the market for boilers, engines, cupola, jib and traveling cranes. A complete electric plant will be installed to light all the new buildings and furnish power for a number of cranes. All the patterns of the company burned and they desire to purchase complete machine shop and pattern shop outfits. They prefer to buy the equipment outright of some establishment that is not now being operated or whose owners are willing to sell.

THE plant of W. H. Mullins, at Salem, O., which makes a specialty of sheet metal and statuary work, is being equipped to burn oil by the system of the Thurman Fuel Oil Burner Co., of Indianapolis, Ind. The furnaces, which are employed to anneal copper and zinc and to melt lead and zinc, are 50′x11′. Waste heat from the melting pots will heat the copper and annealing furnaces.

MINING INSTITUTE.

THIRD MEETING IN THE LAKE SUPERIOR REGION.

The third annual meeting of the Lake Superior Mining Institute, divided between the Mesabi and Vermilion ranges of Minnesota, was in many respects the most successful yet held. The fear that many would be unable to leave their work in the midst of the shipping season, or close to its opening, led to the original appointment of the annual meeting in March, but the conclusion has been reached that mining properties can be seen to so much better advantage when in full operation and that weather conditions will be so much more favorable in the summer season, that hereafter the sessions will be held in August. It is believed that the difficulty of getting away for the few days occupied by the meetings will not be insurmountable to superintendents, company agents, mining engineers and others of the institute. The first meeting, that of 1893, was held on the Menominee range, the second at Houghton, Mich., in the copper country. Ishpeming, Mich., the most important mining point on the Marquette range will probably be visited next August, leaving the Gogebic range for the following year, to complete the circuit.

The meeting held last week—Wednesday, Thursday and Friday, March 6-8—spread over considerable territory. Duluth was the starting point, and there were various mine inspections by the way, with evening meetings at Virginia and Tower. Between 70 and 80 members and guests made the trip. At 10:45 Wednesday morning, soon after the arrival at Duluth of the Duluth, South Shore & Atlantic train, bringing the delegates from the older ranges, the special train provided for the members of the Institute, pulled out over the Duluth, Mesabi & Northern Road. There were half a dozen coaches, all sleepers, or combination sleeper and observation cars, in which the party were housed through the three days and two nights of the trip. While transportation was furnished free by the D. M. & N. and the Duluth & Iron Range roads, the Minnesota members of the Institute provided the sleepers—a bit of thoughtfulness that was appreciated anew with every day that the trip lasted. What with the snow storms that swept up with the greatest precision, in the first two days, simultaneously with the exit of the tourists from the train to inspect a mining property, and the lack of any hotel with convention capacity in the new towns of the Mesabi, their palace-car quarters became a more and more grateful refuge to the membership. Secretary Denton, energetic and thoughtful, had done an immense amount of preliminary work, and his is the credit of the smooth working out of the well-scheduled plans. Helpful as a guide and commentary was the pamphlet prepared by H. V. Winchell, whose name is identified with valuable literature relative to the geology of the new range, as well as with practical work that has gone to establish the place of the Mesabi from a commercial standpoint. The pamphlet gave briefly the location of each mine, the plan of development and operation, output up to the present time, terms of leases, etc., and was distributed among the members soon after the start for the Mesabi range. Copies were also given out of J. E. Spurr's Bulletin No. X, Minnesota Geological Survey, describing the ore, rocks and occurrence of the deposits of the Mesabi.

The party included, with others, the following: Nelson P. Hulst, Wm. D. Van Dyke, Milwaukee; H. V. Winchell, F. F. Sharpless, R. M. Bennett, S. B. Frankforter, U. S. Grant, Dr. Hedderly, Mr. Stacy, Minneapolis; W. J. Olcott, Geo. D. Swift, W. R. Appleby, and H. B. Crowl, Duluth; O. C. Davidson, F. L. Coventry, R. C. Knight, G. A. Alvar, Commonwealth, Wis.; S. T. Beatty, C. S. Simpson, G. C. Trevarthan, Florence, Wis.; Geo. H. Abeel, C. H. Munger, Hurley, Wis.; Wm. Kelly, Wm. Bond, F. Copeland J. W. Curnow, Vulcan, Mich.; C. M. Boss, Bessemer, Mich.; J. Parke Channing, R. H. Channing, Jr., W. M. Brown, New York; F. A. Emmerton, A. I. Findley, Cleveland; James McNaughton, E. F. Brown, Wm. Trestrail, Iron Mountain, Mich.; F. P. Mills, J. M. Vickers, Geo. A. Newett, W. H. Downing, C. T. Mixer, —. Williams, Ishpeming, Mich.; Walter Fitch, Beacon, Mich.; President D. H. Bacon, Tower, Minn.; F. W. Denton, Edwin Ball, Soudan, Minn.; J. F. Armstrong, Biwabik, Minn.; G. W. Wallace, Virginia, Minn.; Theo. Dengler, Atlantic Mine, Mich.; B. W. Goodsell, Chicago;

Profs. L. L. Hubbard and Lane, Graham Pope, A. E. Seaman, Houghton, Mich.; Per Larsson, J. B. Lyon, Norway, Mich.; J. Cocking, Iron Belt, Wis.; Messrs. Fesing, Crystal Falls; J. Orrison, S. P. Snider.

At Mountain Iron and Virginia.

A three hours' run brought the tourists to Mountain Iron, and a half-mile walk north of the hamlet found them in the midst of the open cut from which the largest yield made by any Mesabi mine was taken out in 1894—the record of the Mountain Iron being 573,440 tons sent to market last season. The steam shovels at this property were all idle, but a considerable force of men was at work cutting a large drainage ditch which will take care of the water that may be encountered in the next 20 feet down. Test pitting is in progress, to ascertain the depth of the ore body, something not yet determined. The expectation is that the east cut, which is a half-mile in length, and the west cut will be so connected that in the coming season the empty cars will swing in from the west and go out loaded at the south end of the east cut. This means a great saving of time over the backing-out arrangement necessary heretofore. Stripping has been done sufficient to permit of a large output in 1895—1,500,000 tons could be sent to market, were transportation facilities sufficient.

A short railroad ride toward Virginia takes in the Auburn on the way. This mine, with its complete equipment, well finished office building, new shaft house and power house, is an example of the Minnesota Iron Co.'s thorough-going way of handling its properties. Capt. Geo. W. Wallace has successfully followed the milling system of mining. The deposit was first stripped, then a shaft was sunk and drifts cut to the ore. Chutes were constructed and the ore was milled down through them into tram cars, in turn dumped into 3-ton skips and hoisted. Excellent results have been attained and the output of 111,000 tons last year can be considerably exceeded this season.

Going on to Virginia, two miles distant, the day ended with an inspection of the Oliver mine and other properties close by. The original Virginia was swept off the map by a fire in the summer of 1893, but the pluck of her people has brought a new and greater town into existence—a 20 months' product of surprising proportions. The Missabe Mountain mine, now more generally known as the Oliver, was the largest producer in the Virginia group last year. No work is now in progress, but sufficient stripping has been done to permit of a large output for 1895. It would be much to the advantage of the Carnegie and Oliver interests, who share the lease of this mine, if adjoining properties were worked in connection with it, so that continuous tracks could be built—empty cars coming in at one side and loaded cars going out at the other. The water problem is requiring attention at the Oliver. A shaft has been sunk and pumping is in progress. On the forty immediately east of the Oliver is the Lone Jack, the fee of which has just been acquired by the Oliver Mining Co. Its operation in connection with the Oliver will be an advantageous arrangement. Two inclined shafts have been sunk and considerable work has been done recently by way of exploration. The Ohio occupies the two forties immediately south of the Lone Jack. There have been various changes in the lease of this property. It is now controlled by Geo. Green, of New York, who is having the property developed. The Norman, another stripping and milling proposition, is east of the Ohio. The fee is owned by the Rouchleau-Ray Co., and the mine is operated under a lease by a sub-corporation of the Minnesota Iron Co. The Franklin and Commodore, underground properties, are to the north and east of the Lone Jack. The Franklin ore has brought a higher price than any other Mesabi product, owing to its uniform quality, its high iron and low phosphorus and its granular characteristic, which secures excellent results in the furnace. The Adams mine, one of the best of the Consolidated properties, located about five miles south of Virginia, has an ore much like the Franklin. The Consolidated company is developing the Adams, and finds the deposit one of the largest on the range.

First Session of the Institute.

The evening meeting of Wednesday, held in a Virginia hall, was presided over by J. Parke Channing, of New York, president for the past year. His address was a discussion of the statistics of mine accidents. He showed by elaborate statistics that on the Lake Superior ranges in the past five years the average number of men killed per annum had been 5.67 to every thousand employed. In Prussia the average was 1.356 in the ten years from 1881 to 1890; in 1891 it was 1.25 and in 1892, 1.081. In the metalliferous mines of Great Britain the average was 2.348 per annum per thousand in the ten years ending with 1882 and in the next ten years, 2.145. The speaker dwelt upon the very high ratio of the Lake Superior iron mines, and showed that the number of fatal accidents was inversely as the age of the ranges, the older ranges having better and more experienced men. The operation of the present system of inspection was explained at some length and its deficiencies point. In concluding his thorough treatment of the subject, President Channing recommended the appointment of a commission in each State to prepare an effective inspection law to be made uniformly operative—the commission to consist of a mine manager, a member of the legislature, a mining engineer and a judge.

Supt. E. F. Brown, of the Pewabic mine, Iron Mountain, Mich., read the following paper on

Distribution of Phosphorus and System of Sampling at the Pewabic Mine.

The first shipment of ore from the Pewabic mine was made in the year 1890. During the first three years of active mining, all the ore developed was uniformly a high-grade Bessemer. Exploratory and opening work conducted during the past two years, however, has shown that the mine contains considerable non-Bessemer ore. This non-Bessemer ore varies greatly in the percentage of phosphorus contained. Samples taken at several hundred different points show the maximum phosphorus to be 1.100% and the minimum to be .080%. The average of all non-Bessemer ore from present developments would be about .125% in phosphorus. The high-grade Bessemer ore is uniform in quality. The shipments of the past five years show an average of .008% in phosphorus.

[As an aid to understanding the occurrence of these two grades of ore and their relative positions in the mine, the speaker presented a blue print of a longitudinal section.]

The ore formation has a heavy capping of sandstone, varying from 200 to 600 ft. in thickness. On the west end of the mine, near Shaft No. 1, the vein matter is jasper interspersed with thin seams of low phosphorus ore. As we go east on the third level, 500 feet from the surface, lenses of low phosphorus ore are found nearly surrounded by jasper. These lenses of ore increase in size as they extend upward toward the first and second levels. Near the sandstone these lenses unite, forming a wide body of ore very low in phosphorus, but in many places having but little vertical depth from sandstone to jasper. At a point 1,200 feet east of No. 1 shaft or immediately opposite No. 2 shaft, the ore at the third level becomes practically clean and free from jasper, but near the walls we encounter non-Bessemer ore, while a short distance from either wall the ore is still of a low phosphorus variety. We go 225 feet further and find this level intersecting the junction between the high and low phosphorus ores. Commencing near the second level, at a point 1,550 feet distant from No. 1 shaft, the junction of the two grades has a westerly pitch; 100 feet east of this point and the pitch is reversed.

It is, perhaps, worthy of special note that this junction line conforms very closely to the position of the sandstone capping; also, that originally the sandstone was the carrying medium of large quantities of mine water, until mining work drained the supply to lower levels. The junction line is the bottom of an inclined trough somewhat irregular in contour. The sides of this trough have a height varying from 50 to 150 feet. In some cases the deposit of high phosphorus ore is fairly regular; yet we find instances where large and small bunches of the non-Bessemer ore are completely surrounded by low phosphorus ore. These bunches are always near the main body of high phosphorus ore, usually not more than two or three feet of the better ore intervening. As we approach the junction of the two grades from either direction, the strata, color and general appearance of the ore are unchanged, the percentage of iron being practically the same in either grade. Analysis, however, shows the difference in phosphorus to be great, and the change of grades is very abrupt. As an example: In driving the original or main drift east on the third level, it was the custom to sample the breast of the drift after each cut was blasted. At a certain point the breast gave an

average of .008% in phosphorus. After blasting the breast for a five-foot cut, the broken ore was found to contain .350% phosphorus and the newly exposed breast .750%. The rule here seems to be, that the ore highest in phosphorus is found at the junction of the two grades. As we work into the non-Bessemer ore, the ore contains less phosphorus, although it is not uniform. It will be seen that in mining the low phosphorus ore it becomes necessary to exercise great care.

After some experimenting, the following system of sampling was adopted: For underground sampling, one man was p'aced on each shift. It is the duty of each of these men to sample all the ore broken by the blasts on their respective shifts, also to sample all the new faces developed by the same blasts. The man on the night turn must pulverize the samples taken by him and have them in the laboratory at 7 o'clock A. M., and at 8 o'clock A. M. we have the approximate amount of phosphorus contained in the ore at all the new points in the mine. We are thus able to judge as to the grade of all the broken ore in the mine at the time, also as to the quality of the new faces exposed. The same rule works on the day turn, except that at 7 o'clock P. M. we have received from the laboratory the results of the day sampling. To accurately locate the source of all samples, a base line is established throughout the length of a given level; on the laboratory return, we record the distance north or south of the base line in a given room. For the information of the captains and bosses engaged in handling the ore, a tracing of each room is prepared; on this tracing is marked, at the end of each shift, all the places where broken ore has been left, also the quality of such broken ore, as shown by the samples previously taken.

As a check on the underground sampling, two sets of samples are taken on surface: First, as each tram car is hoisted to surface, the lander will take a large shovel full of ore. At the end of each 10-hour turn, a large sample is formed by combining all the shovel samples taken during the day. This large sample is quartered down to suitable size for laboratory work. The determination of phosphorus in this sample is made as soon as possible. This set of samples is designated as "day" and "night" hoist. The second set of samples is taken from the railway cars, a box containing about 40 pounds being taken from each car. The boxes are numbered to correspond with the car and stored in a shed. When the cars are dumped into a cargo, we receive from the shipping ports a list containing the car numbers of all the cars entering into the cargo. With this list we select the boxes of ore corresponding to the car numbers. The ore in the boxes is all crushed, dumped in one pile, and from this combined sample the laboratory sample is taken in the usual manner.

The following is the method of sampling railway cars: The sampler has four cords attached to two poles. Each cord is one foot distant on these poles from its neighbor. The cords have knots in them one foot apart. These cords are drawn over the top of the loaded car and the sampler takes a small garden scoop of ore from points under the knots irrespective of the quality of the ore. This sample is designated as "cargo sample."

I believe that with this system of sampling cargoes, more uniform results are obtained than is possible by any other method. The two sets of surface samples have a further use as a guard against the mixture of grades caused by careless mining. If the day or night hoist samples show an amount of phosphorus above the ordinary, we know that some ore of poor grade has been hoisted. In this case, all the railway cars composing the particular hoist are held in transit or at shipping port until the box samples representing the cars are analyzed separately. In this way we readily pick out the cars that contain the poor-grade mixture and have them dumped as a separate grade.

During the year 1894, all of the low phosphorus ore taken from the mine came from points near the high phosphorus ore. As evidence of the efficiency of our system of sampling, 301,000 tons of ore were shipped averaging about .007% in phosphorus. This in addition to several thousand tons of non-Bessemer ore mined and shipped.

In the discussion following, Per Larsson, of the Aragon mine, said: "Our chemist goes underground every day or two to take samples from suspicious places, and thus keeps thoroughly posted as to the character of the ore in the mine. We find the good ore on top and the high phosphorus ore underneath. We find that the high-grade ore occurs where the formation has been much broken up, and therefore are always looking for breaks."

Mr. Channing referred to the very low phosphorus ore found at the east end of the Lake Angeline. It was found that the phosphorus was lower where the deposit was wetter, but no deduction was made.

Referring to the Pewabic deposit, Dr. Hulst said that it might be considered as having been at one time of the same phosphorus content as the Chapin ore—about .071 per cent, and that a leaching process had gone on in the coursing of water through the strata, some of the ore being left very low in phosphorus, while in other parts there was higher phosphorus and still a third kind of ore running about .125 in phosphorus. It was estimated that for 600,000 tons of the first kind there would be 300,000 tons of each of the other two.

W. J. Olcott: If the theories proposed as to the location of high and low phosphorus ores are correct, how does it happen that on the Mesabi there is high phosphorus ore on top, then low phosphorus ore, changing farther down to high phosphorus again?

Mr. Fitch suggested that in the case of the Pewabic there was a chance for heavy water courses in the strata just underlying the sandstone, the water eliminating the free phosphorus and carrying it to other portions in which an excess of phosphorus was found.

H V. Winchell suggested the following as a possible explanation of the two zones of the high phosphorus ore in the Mesabi deposits mentioned by Mr. Olcott: The ore deposits were formed in substantially their present form and extent prior to the last glacial period and downward percolating waters may be supposed to have carried the phosphorus from the top portion of the beds to the bottom, causing that high phosphorus zone. After the retreat of the ice, the ore was covered by glacial till, which being made of decomposed green schists, granites and other eruptives might be expected to contain considerable phosphorus. Decaying surface vegetation would add to this phosphorus, and thus there would be a new supply to be carried down into the ore by surface waters. The slight time that has elapsed since the glacial period would not permit this phosphorus to be carried down very far into the ore or through it. The varying character of the till, as to permeability, would account for the fact that low phosphorus ore is sometimes found directly under the till.

F. P. Mills said that the Cleveland Hematite mine was 1,000 feet deep, and that the ore in the bottom was lower in phosphorus than that in any other part.

Mr. Olcott: Last summer at the Mountain Iron we tried to discover whether there was any law as to the occurrence of the low phosphorus and high phosphorus ore. One day in making a cut we get Mountain Iron ore, the next day a high phosphorus ore and then low again. I do not believe study will solve it; we must take the ore as we find it and simply sort it.

Geo. Abeel: At the Montreal mine the low phosphorus ore is in the center of the vein; that near the foot and hanging walls is higher in phosphorus. At the hanging wall it sometimes runs above the Bessemer limit.

F. F. Sharpless, of Minneapolis, read a paper advocating more uniformity in methods of analysis for iron ore, and favored the appointment of a committee by the association to report on a method that might be generally adopted, thus getting in line with the movement among steel works chemists for a uniform method of analysis for steel. The speaker regretted that the exigencies of iron ore shipping compelled the use of short cuts in determinations for iron ore, and suggested that the quick methods accounted for some of the differences between analyses at upper lake ports and those from cargoes at Lake Erie ports. He submitted that ore that started from the head of the lake as Bessemer and landed at Cleveland as non-Bessemer, could not have acquired its extra phosphorus from bilgewater en route.

Mr. Olcutt said that the experience of the Consolidated Co. last season did not bear out the intimation of the speaker. On 296,626 tons of Mountain Iron ore, the Cleveland chemist's cards showed an average of 64.03 in iron, and .043 in phosphorus; the analyses at the head of the lake had averaged 64.33 in iron and .043 in phosphorus. On 40,325 tons the Cleve-

land analyses averaged 63.32 iron and .053 phosphorus; those at the upper lake dock 63.28 in iron and .050 in phosphorus.

Mr. Kelly suggested that there might be danger to the organization in attempting to regulate matters outside its province, and feared that to try to establish a uniform method of analysis might open the door to other efforts in the way of regulations, which might disrupt the Institute. The subject was not pressed further.

Some Pumping Records.

Per Larsson presented on the blackboard some records of pumping efficiency at properties on the Menominee range. The baler referred to was used at the Hamilton mine in connection with a Corliss engine, the plant being furnished by the Webster, Camp & Lane Machine Co. It was not claimed that the figures represented the highest efficiency of the various pumps named, but they were taken from actual practice and were therefore of some value. The table is given elsewhere on this page. At the request of members of the Institute, Mr. W M. Brown, of New York, reviewed the figures presented by Mr. Larsson, giving reasons which might account for the variations in duty. Mr. Mills noted the fact that at Ishpeming a duty of 62,000,000 pounds was secured from a Cornish pump of 18″ cylinder and 60″ stroke.

At a late hour, an adjournment was taken, the session to resume at Tower, the following evening.

Biwabik and Soudan.

An early morning run, Thursday, brought the Institute to Biwabik, ten miles east of Virginia. Being the second locality in which ore was found on the Mesabi and the first to exemplify both the open-pit and the milling systems in its mining, besides having one of the largest deposits of ore, if not the largest, yet uncovered on the range, Biwabik was at once a point of special interest. After a walk of several minutes to the north of the town, the party entered the east cut of the Biwabik, and at once the magnitude of the stripping task was impressed by the depth of the surface and the frequency of the great boulders encountered in the overlying material. Yet the stripping now in progress here, with a limited force of men, is costing but little over 30 cents a yard. The overburden has an average depth of 30 feet, while the thorough test pitting that has been done—more thorough, perhaps, than on any Mesabi property, has shown an average depth of ore on the 120 acres of 75 feet. Computations based on the explorations so far made put the amount of ore at about 25,000,000 tons. In the "Kimberly" or "west" cut, from which over 150,000 tons were taken out in 1893, some idea of the enormous quantity of ore is gained. Much of it is of high grade—a blue-black soft ore in perfectly crystalline grains with little adhesion to each other. Nothing found on the range as yet surpasses in quality the product of the Biwabik.

East of the Biwabik mine is the Cincinnati, the ore of which, though silicious, is quite low in phosphorus. No work is being done here at present. West of the Biwabik is the Berringer mine, and south of the latter, the Canton. The Berringer was the first to adopt the milling system. Its ore was of good quality, but a 50-cent royalty and a high minimum output compelled a surrender of the lease, and the Consolidated Co. now has the property. The Canton's good-sized stock piles, stretching away from its two shafts, loom up to the south of the Berringer. Much of this ore has an ochreish coating, but its analysis tells a better story than its appearance.

The afternoon of Thursday was spent at Soudan, where under the pilotage of President Bacon, who represents what is most progressive, most successful and most intelligent in Lake Superior iron mining, the splendidly equipped properties of the Minnesota iron Co. were inspected. There are huge stockpiles about the eight shafts at Soudan, and 700 men are employed, though twice that number have had work when the output was at its largest. The crushers, of which something was said at the Thursday night session of the Institute, attracted much attention. That the wear on the face plates is such as to require a change every six weeks is easily appreciated when one looks at some of the great flinty masses of ore that are dumped into the hoppers. There are two batteries, of three crushers each. The face plates are of cast steel, in four sections, the lowest one, which wears most, being taken out when necessary, the other three pushed down and the new section put in at the top. The speed is 65 revolutions a minute, much below that of crushers on the Marquette range. Some of the party went underground at Soudan, going 550 feet down to the seventh level. Some idea was got on this trip of the system of filling, initiated here by President Bacon, and worked out to such wonderful efficiency. The Chandler mine at Ely was inspected on Friday morning, President Bacon accompanying the party here also.

The closing session of the Institute was held at Tower Thursday evening. An able address was given by Dr. L. L. Hubbard, of the Michigan Mining School, at Houghton, Mich., on "The Relation of the Vein at the Central Mine, Keweenaw County, Michigan, to the Kearsarge Conglomerate." J. M. Vickers, of Ishpeming, Mich., read a paper descriptive of the hoisting plant at the Cleveland Lake shaft at Ishpeming, giving interesting details as to construction and performance.

Crushing of Hard Ores.

Secretary Denton, who is the mining engineer of the Minnesota Iron Co., read the following brief statement concerning ore crushers in the light of that company's experience:

"I had expected to read at this meeting a paper by Mr. H. J. Wessinger, Master Mechanic of the Minnesota Iron Co., on crushers, speaking of their general construction, and particularly of those points which he believes have not received proper attention, but other matters have delayed its preparation. The following data as to the cost per ton of ore crushed may be of interest: The crushers are charged under these heads—supplies, oils, lumber, fuel, shop labor and material and pay-roll. In the latter account are included the men who pass the material through the crushers, make changes and repairs, engineers' and a portion of the firemen's wages, but not the tramming to or from the crushers.

"During the three months ending Jan. 1st, last, 110,477 tons of ore passed through the crushers,

Costing for supplies	$5,025.00	or	4.54c. per ton.
And grouping the other accounts in one	$3,718.47	or	3.36c. per ton.
Total	$8,743.47	or	7.9c. per ton.

"We have no means of determining what per cent of the ore needs to be crushed, but assuming it to be 60 per cent. the cost was 13.19c. per ton. The company has two crusher plants; at each are a 14x36″ Reynolds-Corliss engine and three 28x30″ crushers; some made by S. E. Cleaves & Son, of Hancock, Mich., and others by the Lake Shore Iron Works, Marquette, Mich. All are of the Blake design. One engine has developed 125 horse power. With 100 horse power an average pressure of something like 170 tons can be delivered, opposite the toggle.

"Wearing faces of chilled iron, tank steel, armor plate, not Harveyized, and cast steel have been tried, the latter giving

[Continued on page 13.]

PUMPING RECORDS AT CERTAIN MENOMINEE RANGE IRON MINES.

Pumps and mines.			Diam. steam cyl. H.	Diam. steam cyl. L.	Plunger. Inches.	Stroke.	Actual stroke.	Displacement per minute. gals.	Slip per ct.	Stroke per min.	Lift, ft.	Coal per hour. lbs.	Duty.	Ash.	Cost.
Vulcan Mine,	Cornish		28	.....	16	120	120	727	9	3.48	1,015	1,089	30,866,000	7.9	$62,421
" "	Worthington		25	43.3	12	36	32⅔	697	5	10.9	1 020	1,053	32,126,000	7.95	20,012
Aragon "	"		15	25	10	24	22⅓	510	5	17.6	522	600	21,147,000	9.6	.....
Pewabic "	"		24	40	12	18	15⅜	870	5	28	691	1,093	26,148,000	6.6	.....
Chapin "	Cornish		50	100	23	120	120	1,342	3	4.39	607	585	68,996,000	.....	.....
Hamilton "	Baler		...	.....	...	.....	.....	2,615	..	1.46*	1,146	. 1,406	63,715,000	7.7	.....

* Time of trip in min.

OPEN-PIT MINING ON THE MESABI RANGE.*

BY F. W. DENTON, M. E.

With the discovery on the Mesabi Range of large, more or less flattened masses of iron ore with, in many cases, shallow covering, interesting problems in mining have arisen. Not the least of these are the questions "How deep will it pay to strip?" and after the stripping is completed, "How shall the ore be mined?" In order to promote a discussion of these questions at this meeting this paper has been prepared.

Thus far two general methods of open-pit work have been adopted: One is to strip a comparatively large area and then, after having loosened the ore by blasting, to remove it by means of steam shovels, railway cars and locomotives. The other method is known as the "milling" system, or better, perhaps, as the "stripping-milling" system. As an example of the last we have the Auburn.

It is impossible to institute an accurate comparison of the two systems without exact figures of costs. It would seem, however, that the use of steam shovels has not the extended application of the milling system, or similar systems, but will be limited to favorable conditions, such as easy grades of approach and easy drainage. The ideal conditions for steam shovel work would occur should the ore lie on a side hill and dip in the same direction as the hill, with its lowest point at, or above, the level of the adjoining country. Under these conditions the grade favors the load and makes drainage easy. Such occurrences of ore are, unfortunately, rare. As soon as it is necessary to carry the bottom of the pit below the level of the lowest ground adjoining, the expense of steam shovel work increases rapidly. Either heavy grades against the load must be used, or long and deep cuts made for approaches, which do not uncover ore. When the conditions are such that only the top 40 or 50 feet of ore favor steam shovel work the stripping cost per ton must be high, as the work must grow in area and not in depth, which calls for fresh stripping each year. Further, the Mesabi deposits are usually very wet, and when natural drainage is impossible, and the water level is reached, shafts must be sunk and perhaps small drifts run in the lower part of the deposit in order to drain the upper portion. This necessarily makes the drainage expense higher than in those systems in which the haulage levels are also used for drainage.

The steam shovel, from a mechanical standpoint, is a very uneconomical machine, and the cost of repairs is high. Locomotive expenses are increased rapidly by adverse grades, for a locomotive can haul on a 2% grade only about one-eighth, and on a 3% grade only about one-twelfth of what it can haul on a level. The economy of steam shovel mining depends upon keeping the shovel constantly at work, in order to maintain a large output. Delays, as we all know, are costly.

In the estimates of cost for this kind of mining that have appeared from time to time, the output of one steam shovel and one locomotive has been taken generally at 2,000 tons per day of 10 hours. This calls for loading a 20-ton car every six minutes. Although this output has often been reached, and even surpassed, it must be considerably above the average for a season. There is usually insufficient tail room to maintain this output, and the delays due to breakages and accidents must further reduce it. Loading these so-called "natural stock-piles" cannot be done under the conditions existing with artificial ones. When conditions are favorable, there is perhaps no cheaper method of removing ore.

In the milling system the work grows in depth, and after a given amount of stripping has been done, all of the ore uncovered may be removed before further stripping is necessary. When the block of ore has been mined, the pit thus made may be used as a place of deposit for the next stripping. It ought to be possible to utilize this advantage to materially reduce the cost of subsequent stripping, for the haul would be short, and by systematic methods, the bottom of the stripping could be dumped into the bottom of the pit, and gravity would thus be made to assist throughout the work.

In the work of removing ore under the milling system, shoveling is entirely avoided until the bottom layer is reached. Tramming is done under the most favorable conditions, and it is not improbable that even the present low cost of this work will be further reduced by utilizing gravity. The average dip of the ore formation is thought to be, at present, about 10 degrees, with local variations up to 20 and 30 degrees. If now, a little more money is spent in exploration, and the general shape of the ore body is determined in advance of mining work, the shafts can be located at the lowest points, and the main drifts run in the gulleys, or hollows, which are likely to exist and parallel to such hollows or gulleys. With this location of shafts and drifts it may be possible, if the dip is as it is thought to be at present, to use self-acting inclines to carry the ore from the working faces to the shafts. If this is possible, not only would the cost of underground transportation be reduced, but the removal of the bottom layer of ore would be simplified. The one disadvantage of the milling system is, of course, the necessity of sinking shafts and putting in drifts and raises. The cost of this work per ton of ore obtained is, however, low, and when we remember that in many of the deposits proper drainage can only be obtained by a shaft and by drifts in the bottom of the ore, this disadvantage is of little importance.

Before entering upon a discussion of the merits of open-pit mining in general, compared with underground work, it may be of interest to mention two or three examples of open-pit mining carried on elsewhere. Although much work of this character has been done in several mining regions of the United States, including our own, the conditions have been very different from those existing on the Mesabi. If, however, any of the members can give the difference in the cost of mining ore in open pits and underground, excluding all expenses except those usually classed under the head of "mining," such figures will be of value in the comparison to follow.

The enormous deposits of iron ore and copper-bearing pyrite of Spain correspond very closely, in the conditions presented for mining, to those of the Mesabi. The following extracts are from a paper by B. J. Forrest in the transactions of the N. E. Inst. M. E.'s, Vol. XXXIII, 1883-84, and refer to the iron deposits:

"The mines are invariably worked open-cast, or in quarries. Some of the larger quarries are worked in two or three lifts of from 12 to 14 yards high. The base of the ore is attacked by driving a tunnel, or gallery underneath the floor of the mine, and wagons can thus be loaded direct from the faces. * * Jumper drills are generally used, weighing on an average 25 to 30 pounds, and larger ones from 150 to 200 pounds, and are 30 feet long."

M. Haton de la Goupilliére, in his treatise upon exploitation of mines, and in the chapter devoted to open-pit mining, gives an example illustrating the combination of open-pit with underground mining. The mine cited is an iron mine in Algeria. [A sectional drawing was shown by the speaker, illustrating the method employed at this property.]

"The foot wall is an impermeable schist. The dip varies from 15 to 45 degrees. The hanging wall is a calcareous rock, sometimes replaced by a schist similar to that of the foot wall, but more tender. The deposit forms a continuous mass for 4,900 feet along the strike. Its thickness, which has an average of 16 feet, reaches, and even surpasses, 49 feet at the enlargements. The mineral is an intimate mixture of magnetite and hematite giving 60% of iron in the blast furnace. The magnetic oxide tends to predominate in depth and near the limestone, becoming very hard. The mine is laid out for an annual production of 300,000 tons, but the fluctuation of the working population often lessens this amount. It is exploited at this time (1883) by both surface and underground work, the output being in the ratio of one (1) from underground to five (5) from the surface.

"The open works are conducted in upright steps. They are intimately connected with the interior, into which they discharge the mineral and water. The flow of water is about 90 to 130 gallons per minute, with increases during the rainy seasons. It is raised by two pumps, with a third kept in reserve, located in a shaft 213 feet deep. The materials are thrown into raises walled up with masonry, and widened towards the bottom, from which the loading is done direct into the cars of the Bône railway. These last circulate in galleries laid out in the direction of the strike, with a development of 3,900 feet. The chief ones are located at four different levels: that of the sea, two lower stages at —49 feet and —115 feet, and a

*Read at the meeting of the Lake Superior Mining Institute at Tower, Minn., March 7, 1895.

higher stage of +85 feet at the railroad level. The wagons, which weigh five tons, are received individually upon the cage of a great inclined plane having a counterpoise and a safety device, which lifts them to the railroad level. In establishing equilibrium between the two methods of attack it is necessary to consider:

"First. The cost of removing the covering, its depth, its natural slope, which is generally one of base to two of height, and rarely reaches 45 degrees.

"Second. The thickness of the mineral, the contents of a cubic metre in merchantable tons, and the cost of breaking the mineral, which varies with the hardness.

"In general it is admitted that one can remove two cubic metres of schist for one of mineral. One is urged to increase the depth, when the labor underground, more difficult than that of the surface, becomes scattered, or when the mineral becomes exceptionally hard. One is restrained, on the other hand, if movements of the banks are feared, or when the handling of the earth cannot be sufficiently rapid to avoid delay."

The same author gives the costs of underground and open-pit mining as determined at one of the mines at Rio Tinto as follows:

	Open pit.	Underground.
Breaking, manual labor, superintendence and explosives	$.154	$.386
Sorting, loading, transportation	.232	.338
Maintenance of tools, rolling stock and road	.097	.145
Total	$.483	$.869
Removal of covering and waste	.193	
Total	$.676	$.869

In other kinds of mining, notably in coal mining, and quarrying, stripping has been carried to great depths. The conditions, however, are such as to make the difference in the cost of removal with and without stripping, much greater than in the case of iron mining. Callon states for coal mining, that theoretically when the thickness of the overburden is equal to the thickness of the coal multiplied by 2.7, it is a matter of indifference whether we adopt open or underground working, and adds, "This result agrees very well with practical experience." In these computations Callon assumes the cost of removing a cubic yard of dirt to be 15 cents, and the saving in the cost of mining, after stripping, to be 40 cents per cubic yard of coal. A cubic yard of coal is assumed to contain ¾ of a ton. Haton de la Goupilliére gives an example in which a horizontal coal seam 90 feet thick, with a covering of schist of about twice the thickness of the coal, is stripped. The schist is first undermined by a series of drifts on top of the coal, and then the supporting pillars are blasted simultaneously, which results in breaking down the schist above.

Suppose we now undertake a comparison of open pit with underground mining.

Chief advantages of the open-pit method:

1. There is less danger to the workmen from falls of roof and blasting, and the chances of fire are less.

2. Economy in mining due to (a) the possibility of using large stopes, and large blasts, and thus avoiding the narrow working places necessary in underground mining—an advantage which increases with the hardness of the ore. (b) The easier and better superintendence. (c) The saving of the cost of timbering. (d) The saving in the cost of tramming. (e) The small saving in the cost of lighting.

3. All of the ore can be mined with equal ease and absolute certainty, thus avoiding the loss of ore more or less great, which must always accompany underground work.

4. Saving of the expense of making stock-piles and subsequent loading.

5. As the output per man per day is increased anywhere from two to nine times, the increase in cost due to an increase in wages will be less.

6. If the ore requires sorting, it can be done cheaper and better in daylight. Or, if thorough mixing is desired, it can be done better in open-pit mining.

Chief disadvantages of the open pit method:

1. The necessity of providing a place for the wase material removed. This has been a chief source of difficulty elsewhere, and no doubt will often be so on the Mesabi.

2. If in masses of glacial drift, beds of sand, or quantities of unsalable ore are met with, they must be handled. In underground work these deads could be left in place, or at least would not have to be handled.

3. The expenses of open-pit work increase rapidly with the depth of covering, while those accompanying underground work are independent of this depth, at least up to the point when stripping is no longer a possibility.

It is evident from a consideration of these advantages and disadvantages, that as the ore bodies recede from the surface, a limit is soon reached at which they neutralize one another, and beyond which stripping ceases to be economical. In order to determine this limit it is necessary to assign definite values in dollars and cents to these advantages and disadvantages, so that we may know exactly how much may be spent for stripping. The problem, therefore, is a very simple one in the abstract, but a very difficult one practically, owing to the impossibility of determining in advance with certainty the cost of mining a given ore body with, and without, its covering.

Once this quantity is determined, the depth at which stripping should cease, will depend simply on the cost of the stripping per cubic yard, or other unit, and the amount of extra stripping necessary to give the banks safe slopes. Of the advantages of open-pit mining just enumerated, No. 2, or the economy in mining, is by far the most important in a discussion of this kind. The other advantages and disadvantages will depend, more or less, upon the conditions surrounding each case, and their money values can be determined with considerable accuracy when the conditions are known. By permission of the officers of the Minnesota Iron Co. I am able to announce one value for advantage No. 2 for Mesabi ores. This value has been deduced from a comparison of the costs at the Auburn and Norman mines with those of the Canton. All of these mines are on the Mesabi Range. The Canton is an underground mine and has been worked by the North-of-England system, the Nevada system, and to some extent by making large rooms next the covering of the ore, without timber.

The Auburn and the Norman mines have been worked under the milling system which has been described. These three mines have been accurately compared with regard to—

1. The cost of mining labor, which includes all miners, trammers, timbermen, mine captains and foreman, skip tenders and underground laborers.
2. The cost of timber.
3. The cost of explosives.

All other expenses were assumed to be equal. Average wages were brought to a uniform standard of $1.50. The results show a difference of 21½ cents per ton of 2,240 pounds in favor of the milling system. The difference is probably less than it will be in the future, because—

1. The Canton costs are low, as the mine may be said to have reached its prime, and considerable ore has been won in large openings. When pillars shall have been robbed, and the remaining ore mined by some caving method, the average costs for the whole deposit will be higher than those used in this comparison.
2. The cost of timber at the Canton has been low, owing to the quantity of work done without using timber.
3. The Auburn and Norman have been able to mine but little ore on account of the dull season, and, therefore, have had but very short runs in which the mines were producing all the ore that their equipments and forces were capable of producing.

The Auburn costs were computed from a single run of less than one month, with a product of 53,632 tons, and those of the Norman from two short runs in the months of August and September, during which the output was 27,058 tons. The Canton figures were the averages for six months, and an output of 173,000 tons.

In addition, the introduction of new methods must always require a certain amount of time and practice in order to reach normal mining conditions. This practice the Norman and Auburn have hardly had.

Let us assume, however, 21.5 cents per ton to represent the value of advantage No. 2, and neglect all others, as well as the disadvantages; also let us assume that a cubic yard of ore will furnish two tons, and there is no stripping for bank slopes. Then, with stripping at 40 cents per cubic yard, we can afford to remove 1.07 yards of stripping for one of ore. In deep stripping, the proportion which goes to give the banks the proper slopes will be comparatively large for the first cut, and will depend not only on the natural slope of the material

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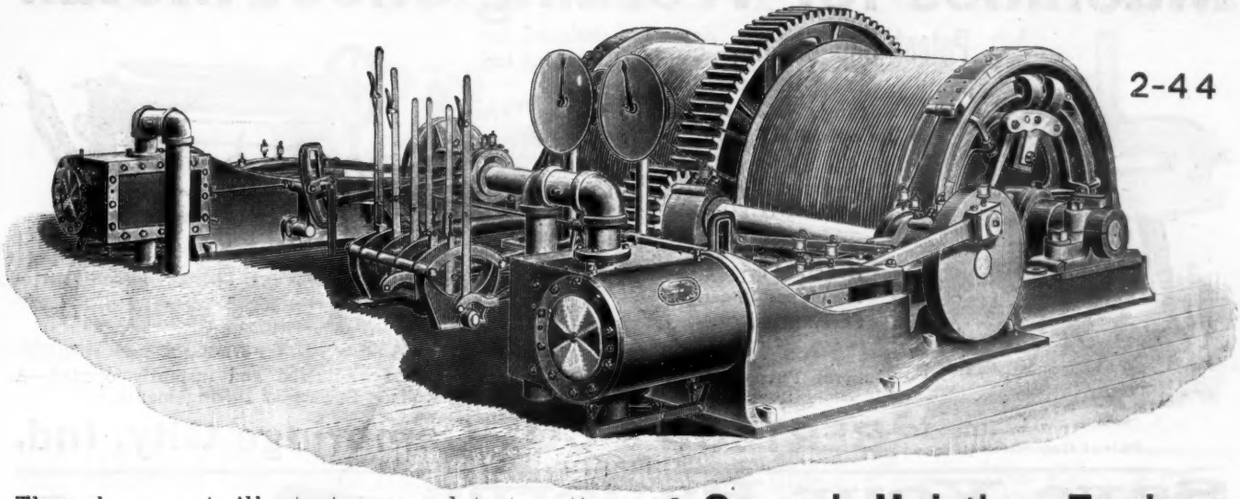

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and the depth, but also upon the shape of the area excavated.

It will be less for a given area, material and depth, as the shape approaches that of a circle. In the subsequent stripping, however, the proportion will be much less, as the shape of the area stripped will generally be that of a long and narrow rectangle, and only the end slopes would have to be considered, or if a square area is uncovered in the first place, only the slopes of two sides would enter in the subsequent stripping estimates. Therefore, if nothing has been overlooked, it is safe to state that the following proposition, offered at the inaugural meeting of this institute, by Mr. Larsson, is correct for the Mesabi, namely:

"That where the volume of ore to be uncovered is equal to, or greater than the volume of surface to be removed, it will pay to strip."

The loss in underground mining is liable to be anywhere from 10 to 30 per cent, and therefore from 11 to 43 per cent of the profit per ton, if mined in open pit, should be added to the cost of underground mining when comparing the two methods. Owing to the uncertainty of this item, however, it has been neglected. If in the future the cost of stripping can be reduced, the economical limit of open-pit mining will be increased, and it will not be surprising if, at no distant day, two cubic yards of covering are removed for one of ore, when the ore is hard, of good quality, and marketable at a respectable profit.

Western Foundrymen's Association.

The next regular meeting of the Western Foundrymen's Association will be held on Wednesday, March 20, at 7:30 P. M., at the Great Northern Hotel, Chicago. The "question meeting," which was so very interesting last month, will be continued at this meeting, and considerable time will be devoted to the question of keeping foundry costs, which was discussed to some extent at the February meeting. It is earnestly desired that all foundrymen attend this meeting, and the secretary will take it as a favor if those who intend coming will so notify him.

J. H. BASS, manufacturer of car wheels and railroad castings, has moved his office from 97 Dearborn st., Chicago, to room 707 the Rookery, where he will be a little nearer the center of the iron and railroad business than in his old location.

THE Bethlehem Iron Co. started its steel works with 1,000 men, on Monday, after two months of idleness. A 12,000-ton rail contract for a Georgia road will be filled first.

(MINING INSTITUTE.—Continued from Page 10.)

twice the service of any other. A trial of finished armor plate would have been made, but the manufacturers were unable to promise a perfect fit, and assured us that after being treated we could not touch the metal with tools."

Mr. F. P. Mills, who was called upon by the president to tell something about the experience of the Cleveland-Cliffs Iron Co. in the use of crushers at Ishpeming, created some mirth by stating that they had crushed 35,000 tons of ore and had succeeded in breaking 105,000 pounds of castings. The crushers originally put in weighed 47,000 pounds; they were strengthened up to 80,000 pounds. The first crushers were continually breaking. Those installed later were furnished by the Lake Shore Iron Works at Marquette, and a two years' guarantee given. In the copper country crushers are run at a speed of 150 to 180 revolutions; those at Ishpeming made from 235 to 250 revolutions per minute. They were driven by heavy belts. From 180 to 200 h. p. was employed.

Walter Fitch, being asked to tell of the operation of the crushers put in at the Champion mine, said that the expense per ton did not approximate that reported by the Minnesota Iron Co., but the ore at the Champion was not so hard. He asked Mr. Mills whether the excessive breaking of castings in the crushing operations at Ishpeming was thought to be due to the high speed or to the effort to crush the ore very fine. Mr. Mills responded that probably the fineness of the ore was responsible for the crushing of so many castings. The ore as it came from the crushers being reduced to ¾″ to 1″.

Probably the most interesting paper of the evening from the standpoint of the Mesabi contingent was that of Secretary Denton, on "Open-Pit Mining, with Special Reference to the Mesabi." It is given in full on other pages.

The election of officers resulted in the choice of the following:

President: John Duncan, Calumet, Mich., assistant superintendent of the Calumet and Hecla mine.

Vice Presidents: F. McM. Stanton, Atlantic mine, Mich.; Geo. A Newett, Ishpeming, Mich.; Per Larsson, Norway, Mich.; with W. J. Olcott and R. A. Parker, Duluth, holding over.

Managers: F. P. Mills, Ishpeming, Mich.; Edwin Ball, Soudan, Minn., with O. C. Davidson, Commonwealth, Wis., and M. E. Wadsworth, of Houghton, Mich., holding over.

Treasurer: Geo. D. Swift, Duluth, Minn.

Secretary: F. W. Denton, Soudan, Minn.

After the inspection of the Chandler property at Ely, Friday morning, the special train made a quick run to Duluth, from which point the members scattered by the evening trains.

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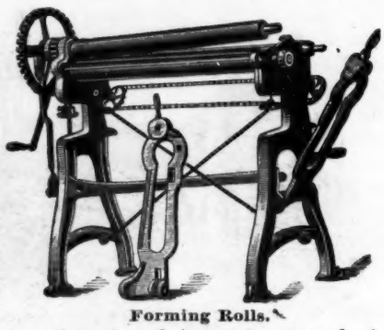

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INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

M. B. 106 43d st., Chicago, wants a second-hand Hoskins blower and furnace and assay work.

Smith, 113 W. VanBuren st., Chicago is in the market for a 6 h. p. gas or steam engine, and shafting.

The Chicago Wooden Ware Co., 21st and Brown sts., Chicago, want to buy a second-hand 40 h. p. fire-box boiler.

The Braun Automatic Scale Co. has been incorporated at East St. Louis, Ill., with a capital stock of $100,000.

William E. Smith will commence the manufacture of agricultural machinery at Watkins, N.Y., in the near future.

The Cleveland, Lorain & Wheeling Railroad Co. is asking bids for the construction of 20 steel bridges, to replace wooden structures along its line.

The Globe File & Iron Co. has been formed at St. Louis, Mo., by Chas. H. Niekamp, Henry Speck, Chas H. Osthoff and others, for the manufacture of files and other iron and steel products.

The Clyde Wire Fence Co. has been incorporated at Lyons, N.Y., for the manufacture of wire fence, by H. W. Levanway, J. N. Neal, M. W. Meade, R. R. Barnes and R. T. Van Valkenberg. The capital stock is $26,000.

The J. D. Hooker Co. has been incorporated at Los Angeles, Cal., by J. D. Hooker, Katharine P. Hooker, Marian O. Hooker, Wm. S. Porter and F. K. Simonds, with a capital stock of $200,000, for the manufacture of pipe, fittings, boilers, tanks and other articles.

Roswell P. Flower, Sarah M. Flower, Emma K. Schley, Emma F. Taylor and J. B. Taylor have recently incorporated the Hitchcock Lamp Co. at Watertown, N. Y., and will manufacture lamps and other brass goods and novelties. The capital stock is $100,000.

New Construction:—

Ground has been broken at Tifton, Ga., for the new Tifton iron and brass foundry and machine shop.

Ground was broken last week for the construction of the new tin plate plant of the Laughlin Nail Co. at Martin's Ferry, Ohio.

Munson Bros., of Utica, N. Y., will at once begin rebuilding their foundry, which was destroyed by fire recently. A new molding shop will also be built by this concern.

At the new power plant for the Nassau Electric Co., at South Brooklyn, N. Y., the engine and dynamo room, 58 feet by 150 ft., is equipped with a 13-ton crane having a travel the full length of the building. The boiler room is 47 ft. by 150 ft. and is so arranged that 2,000 tons of coal can be stored in the pockets. The entire construction is of iron and the buildings, when completed, will be fire-proof.

Additions, Enlargements, Removals, Etc.:—

The Hill Machine Co., of Anderson, Ind., will increase the size of its machine shop in the near future.

Nearly all the machinery of the New Castle rod mill is being repaired, including the rolls and the cylinders of the engines.

On Saturday, March 23, the offices of the Carnegie Steel Co. and the H. C. Frick Coke Co. will be removed from their present locations to the new Carnegie Building, in Pittsburg.

The new furnace recently built by the Bellaire Nail Works has been put in blast. It is expected to make from 250 to 300 tons of Bessemer iron per day, and this in connection with that turned out by the old stack, will supply this concern with sufficient iron to keep up with its converting capacity.

The firm of Huntley, Cranson & Hammond, of Silver Creek, N.Y., manufacturers of milling machinery, has been formed into the corporation of the Huntley Mfg. Co., with a capital stock of $100,000. The officers are Wm. W. Huntley, president; C. G. Hammond, vice-president; B. F. Reyer, secretary.

The Kurtz & Buhrer Foundry Co. has been organized at Chicago to operate the foundry at 832-840 Austin ave., formerly run by Kurtz & Buhrer, a firm established in 1869. The new company has a capital stock of $60,000, and is incorporated by George Kurtz, John S. Buhrer, and James A. Brady. Mr. Brady for the past 12 years has been connected with the Chicago

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick.

GOVERNMENT ⁂ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

Home Office and Works:—MOUNT SAVAGE, Allegany County, Md.

Branch Offices:—No. 1 Broadway, New York, N. Y.; No. 222 So. Third St., Philadelphia, Pa.; Ferguson Block, Pittsburgh, Pa., Stowe, Fuller & Co., 195 Merwin St., Cleveland, Ohio.

THE AMERICAN FIRE BRICK & CLAY CO., Mineral Point, Ohio.

HIGH GRADE FIRE BRICK for

Rolling Mills, Steel Works, Blast Furnaces, Cupola Linings, Boiler Settings.

— All Shapes in Stock —

Our large capacity, 8,000,000 annually, and modern plant, enable us to handle contracts of any size promptly.

Ground or Calcined Clay in Sacks or Bulk.

Stowe, Fuller & Co.

WESTERN AGENTS OF

Mount Savage and Queen's Run Fire Brick,

The leading BRICK of this country.

MANUFACTURERS OF

OHIO FIRE BRICK. ALL SHAPES IN STOCK.

The largest shippers of FIRE BRICK in the West.

Warehouse and Docks: 193-195 Merwin Street,

CLEVELAND, OHIO.

Hardware Mfg. Co. as superintendent of the foundry department, and brings to the new concern a large amount of practical experience, and a wide acquaintance. This foundry is one of the largest and best equipped jobbing foundries in the city of Chicago, and has connected with it a well equipped pattern shop and machine shop, as well as a plant for japanning, galvanizing and nickel and copper plating. The old firm has always enjoyed a good trade in fine gray iron castings for electrical work and hardware specialties, and it is the intention of the new company to increase its facilities so as to enable it to keep in the lead in both the quality of the goods manufactured and in promptness in the execution of orders.

The Junction Iron & Steel Co., Mingo Junction, O., has bought farm land adjacent to its plant, a dispatch says, and will put up a new finishing mill.

Fires and Accidents:—

A recent explosion at the Red Jacket furnace, New Castle, Pa., injured six men.

Vulcan Iron Works, Cairo, Ill., suffered from fire recently, with a loss of $10,000; covered by insurance.

At Detroit, fire destroyed the Detroit carbon works, stamping works and several smaller concerns. Loss $250,000.

The extensive foundry plant, formerly operated by the Bouton Foundry Co., at 40th st. and Union ave., Chicago, and lately occupied by the Challenge Machine Co., was almost destroyed by fire last Sunday. The foundry was not being operated at the time, but it was well equipped. The Challenge Machine Co., which makes printing presses and paper cutters, was burned out three months ago. It will soon occupy its own new plant which is nearing completion. The loss on building and the original machinery equipment, owned by Henry Perry, is $50,000. The Challenge Machine Co.'s loss is $25,000.

General Industrial Notes:—

Sligo furnace, Sligo, Mo., blew out recently for an indefinite period.

Over 75 cars of coke are consumed daily by the six furnaces at Sharpsville, Pa.

The Cohoes (N. Y.) Tube Works have resumed, after stopping to add improved machinery.

No. 2 furnace of the Dunbar Furnace Co., Dunbar, Pa., has been blown out and No. 1 put in blast.

The Covington (Ky.) Machine Works, which shut down recently, are now being operated to their usual capacity.

The Whitaker Iron Co. has increased by 200 the force at work in its sheet mills. A good demand is noted for black sheets.

English capitalists were in Sharon, Pa., recently, looking over the ground with a view to placing tin plate works there.

An explosion at the Youngstown Steel Co.'s furnace at Youngstown, damaged hopper and bell, but no one was hurt.

The Duquesne works of the Duquesne Tube Works Co., of Pittsburg, Pa., have been put in operation to their fullest extent.

The Baugh steam forge department of the Michigan-Peninsular Car Works, Detroit, Mich., has started up to its fullest capacity.

Valentine furnace of the Valentine Iron Co., Bellefonte, Pa., has shut down for repairs, and it is expected will be blown in again April 1.

A Pittsburg party composed of B. F. Jones, Jr., W. F. Jones and C. C. Briggs, of Jones & Laughlins, inspected the Ohio Steel Co.'s plant at Youngstown last week.

Rockwood furnace of the Roane Iron Co. is now out of blast undergoing repairs, but will blow in again soon. Citico furnace, operated by the same company, is in blast.

The Brazil Foundry & Machine Shops, Brazil, Ind., have resumed work on full time with full force. For two years the plant has been working half time with half force.

The Westinghouse Electric Co.'s plant at Brinton, Pa., has 4,000 men at work this week, an increase of 1,000. The Westinghouse Air Brake Works at Wilmerding are running double turn, employing 3,200 men.

The Buckeye Engine Co., Salem, O., has booked a number of orders recently, including several engines for new industries. More men are at work now than in 1894, and steady employment is insured for some time to come.

At the annual meeting of the stockholders of the Sandwich Enterprise Co., Sandwich, Ill., held recently, the old board of directors was re-elected, and the capital stock of the company was increased from $100,000 to $250,000. The business of the company will be extended materially.

At Troy, N. Y., the Troy Steel & Iron Co. is making an effort to secure exemption from taxes. The plant has been idle for several years, and a year or so ago passed into the hands of a receiver. It is stated that if taxes are remitted, capitalists will buy the plant and put it in operation.

A Birmingham, Ala., dispatch says the Bessemer Savings Bank and Bessemer Land & Improvement Co. have attached the Alabama Pipe Works at Bessemer for $10,000, and that the attached company responded with suits for damages, alleging $80,000 of assets and only $20,000 of liabilities.

The Niles Tool Works Co., Hamilton, O., has recently taken up the subject of electrically driven tools, and has made tests of direct-driven tools, where the motor is attached directly to one of the driving spindles of the machine, this arrangement eliminating the question of belting entirely. The tests show that good results can be obtained by this method.

The Calumet Iron Works is the name of the new organization that will operate the foundry of the Automatic Mower & Mfg. Co., at Harvey, Ill. The plant has been leased to the new company for one year with the option of renewal for another year. The incorporators are A. L. Hott, W. E. Kreamer and A. D. Lawson. George Wilcox will be elected superintendent of the new company. The capital stock, $10,000, has been subscribed.

W. L. Lee & Co., 273 and 275 S. Canal st., Chicago, have started a special sale of machinery which will continue for 30 days. This concern expects to remove within a few weeks to a location a little nearer the machinery district, and the present sale is to clear out some of their stock prior to removal. The list of tools they send out in the announcement of the sale is very large, and includes both new and second-hand tools of every description, both iron and wood working.

Home-Seekers Excursions South and Southeast via Pennsylvania Lines.

Special low rate excursion tickets with twenty day return limit will be sold March 5th, April 2d and 30th, from ticket stations on the Pennsylvania Lines to points in Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee and Virginia. For details, apply to nearest Pennsylvania Line Ticket Agent, or address F. Van Dusen, Chief Assistant General Passenger Agent, Pittsburg, Pa.

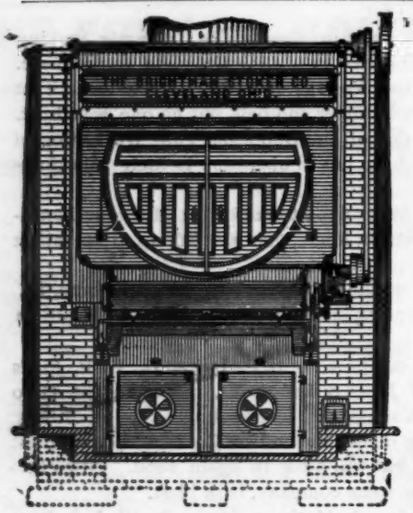
Excursion to Cleveland, March 19th.

From all stations on the Valley Railway, on account of the Theodore Thomas Orchestra Concert; tickets good returning on any train of the 19th, and all trains of March 20th, 1895.

For tickets and full particulars call on any agent Valley Ry.

WHEELMEN find that some lubricant is needed to prevent wear of chain and sprocket wheel. Such a lubricant also increases speed and ease of driving. Oil or grease catches and holds dust and dirt. Experiment has shown that graphite makes the most perfect lubricant, when the right kind is used and properly prepared. Under the name of graphite lubricant are found compounds of cheap black lead, stove polish, foundry facings, soapstone, etc. Safety in buying and the assurance of getting the best graphite lubricant made, lie in purchasing from makers of reputation and experience. The Joseph Dixon Crucible Co., of Jersey City, N. J., have mined and manipulated graphite for nearly 70 years. When called upon to furnish a cycle lubricant that would meet all the requirements, they purchased samples of all the chain lubricants in the market and analyzed them, and then selected from their stocks of graphite a brand of unequalled smoothness, and produced a stick, or solid lubricant, which they affirm will not gum or hold dirt and dust, but which will thoroughly lubricate the chain and sprockets, reducing the wear to the slightest degree, and increasing speed and ease of riding.

AMERICAN pig iron storage warrant stocks were 124,000 tons, March 10.



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IN THE WORLD.
Send for descriptive pamphlet.
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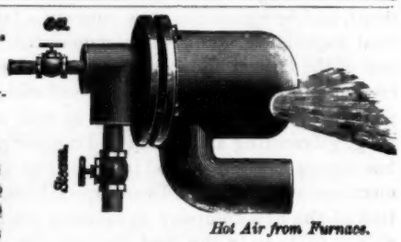
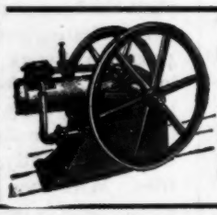
THURMAN FUEL OIL BURNER CO.
Gen'l Offices, 35 and 36 Cordova Bldg.,
INDIANAPOLIS, IND.
Acknowledged the best for Boilers, Forges, Furnaces, Ovens, etc. Write for Catalogues.

BURNER NO. 0.


Hot Air from Furnace.
BURNER NO. 4

J. POWER HELY, Chicago Manager,
1405 Monadnock Block, Chicago, Ill.
NOTE.—If you are using oil as fuel, and are not getting good results, we would be pleased to nd you our burners on trial. The oil in our burners an be atomized by either steam or air.

Fred. F. Sharpless. Horace V. Winchell.
SHARPLESS & WINCHELL,
809 and 811 Wright Block, MINNEAPOLIS, MINN.
Analytical Chemists and Assayers.
Consulting Geologists and Mining Experts.
Mines examined. Advice given on treatment of ores and development of properties.
Intimate acquaintance with Lake Superior Mineral Regions.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Are the latest and best Vertical and Horizontal Engines on the market. Simple and well constructed.
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DAYTON, O.

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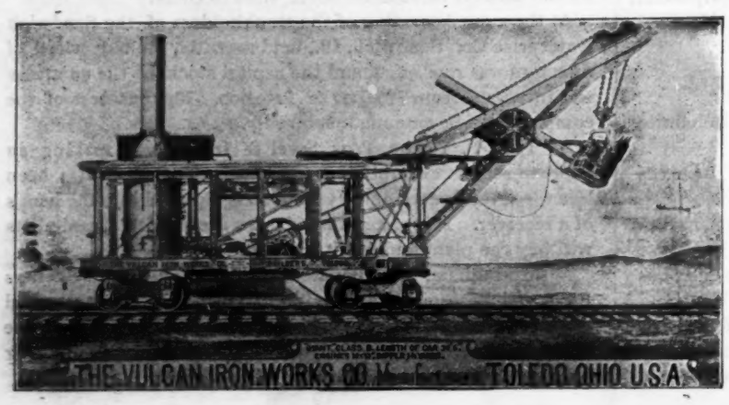
Mining Reports and Estimates. Spanish-American Business a Specialty.



STEAM SHOVELS!
VULCAN IRON WORKS CO.,
TOLEDO, O., U. S. A.

There is no Steam Shovel on the market so well adapted to handling Iron Ore as our "Giant." We guarantee 2,500 tons in ten hours.

Our "Giant" has the record on the Mesabi Range.

WHY USE COAL

WHEN WE CAN RUN YOU ON OIL FOR LESS MONEY?

Cheaper than Coal. Requires No Expert to Manage.

MANUFACTURED EXCLUSIVELY BY

THE THURMAN FUEL OIL BURNER CO.,

Designers, Contractors and Engineers for Complete Fuel Oil Equipment.

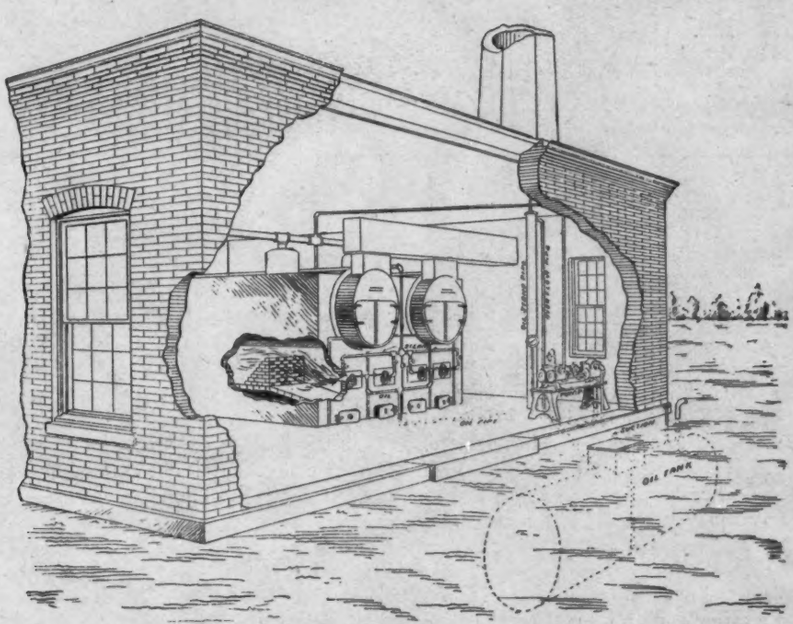
General Offices, 31 and 32 Cordova Building, INDIANAPOLIS, INDIANA.

ACKNOWLEDGED THE BEST

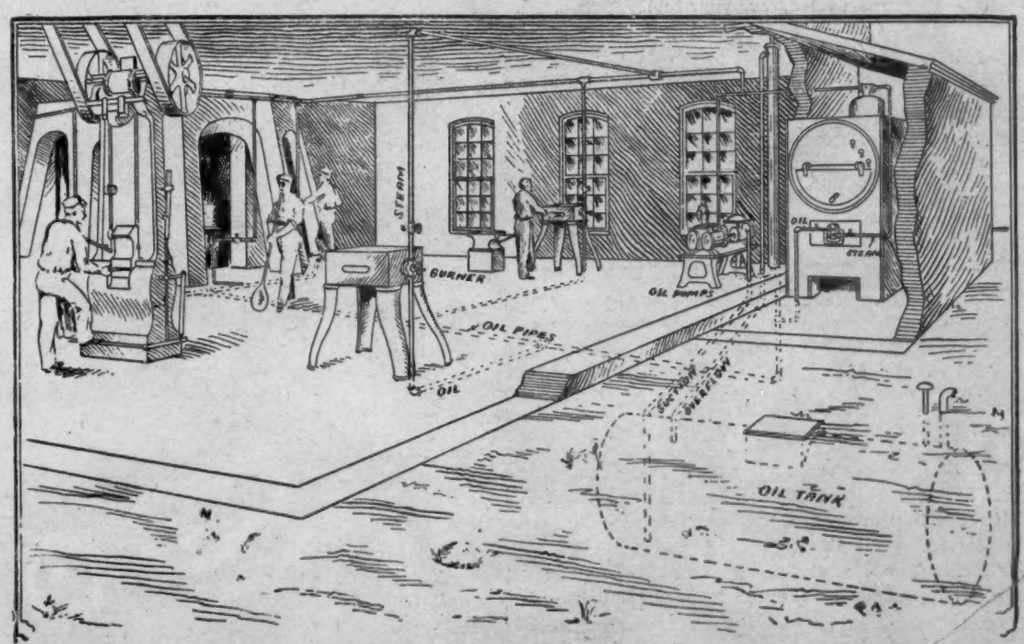
FOR BOILERS, FURNACES, FORGES, PUDDLING FURNACES, GLASS MAKING, MAKING ARTIFICIAL TEETH, BRICK KILNS, POTTERIES, OVENS, DRYERS, ETC., FOR EVERY BRANCH OF INDUSTRY WHERE HEAT FOR ANY PURPOSE IS USED. THE ONLY ECONOMICAL SYSTEM EVER INVENTED.

PATENTED.

Generates Pure Hydro-Carbon Gas. Absolutely Smokeless. No Soot. No Sparks. No Odor.



Thurman Fuel Oil Burner Co.'s System as applied to two Horizontal Tubular Boilers at the Indiana Institution for the Education of the Deaf, Indianapolis.



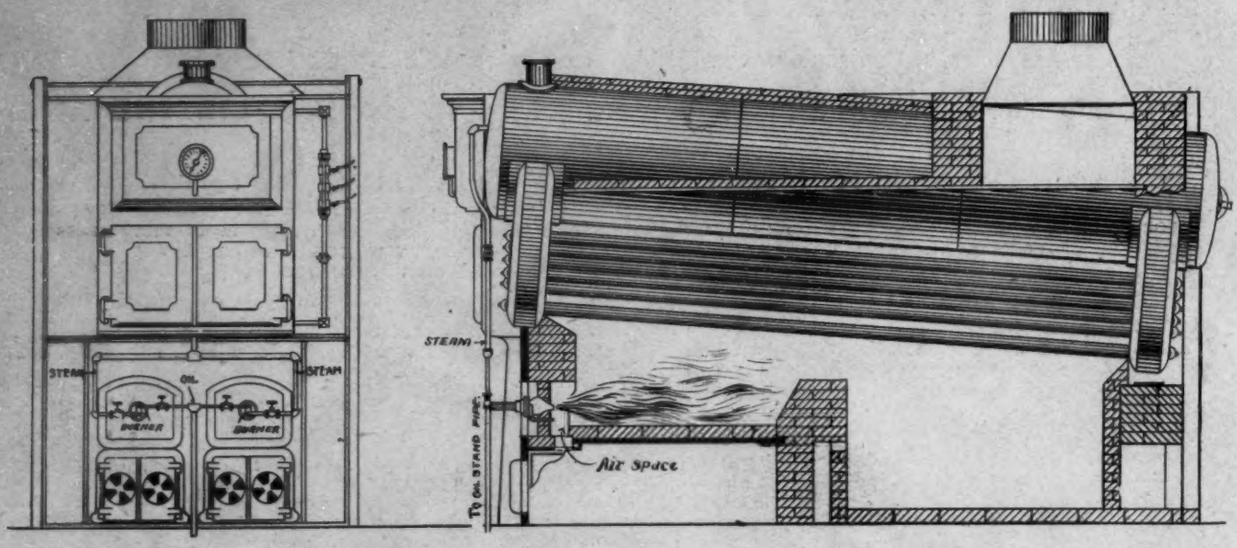
The Thurman Fuel Oil Burner Co.'s System of Burning Crude Petroleum as applied to Boilers, Furnaces, Forges and Glass Works.

THE THURMAN BURNERS ACKNOWLEDGED THE BEST.

THE THURMAN FUEL OIL BURNER CO.

Designers, Contractors and Engineers for Complete Fuel Oil Equipment.

General Offices, 31 and 32 Cordova Building, INDIANAPOLIS, INDIANA.



Front and Sectional View of a Water Tube Boiler, showing the Thurman Fuel Oil Burner Co.'s Burner applied.

THE THURMAN BURNERS ACKNOWLEDGED THE BEST.

OUR system of burning crude oil is adapted to all classes of work, such as boilers, and reverberatory furnaces of all kinds. Copper and brass are melted in crucibles at one-half the cost of coal, and the crucibles are more permanent. Puddling, forges, dryers of all descriptions. Glass making and working are successfully accomplished with large savings in fuel. Burning brick, tile and pottery of all kinds. Our burners generate pure hydro-carbon gas, and wherever used every unit of heat the oil contains is utilized and applied without any expensive intermediate process of treatment. Our system is accepted and endorsed by the leading insurance companies of the country.

Our method of producing hydro-carbon gas is the greatest improvement that has been brought about by the introduction of crude oil as a substitute for coal as fuel. Its success as a heat producer is no longer an experiment, but a fact established beyond all doubt. It is a clean, convenient and economical fuel, producing the required results.

Its numerous advantages over coal will readily be appreciated from the following important facts: The trouble attached to the handling of coal. It costs at least five cents per ton to unload, providing you have a switch to your bins, and yet it has not been distributed about the plant. There is a shrinkage of five per cent in weights, and about the same in waste by handling. Then it is an impossibility to burn and not consume a certain amount of coal from which no benefit is derived, caused by the necessity of opening the doors, and cold air rushes in, causing an immediate and reverse change to take place, while with oil, if your fires are too not, turn a valve, save your fuel.

The labor of feeding the fires, clinkering the boxes, taking care of ashes and the wear on boilers, kilns, etc., are unknown in the use of oil.

One car of oil is equal to three cars of coal, and by attaching a rubber hose or gas pipe, in two hours you have obtained the results of the labor of one man for one and one-half days, and only consumed about ten minutes in preparing for the operation of unloading, which afterwards needs no attention. By the aid of a pump your fuel is distributed and ready for use.

It is obvious that our system is the simplest, and has the advantage over our competitors by generating pure hydro-carbon gas by the direct use of the crude oil, and needs no further discussion.

INDIANAPOLIS, Nov. 7, 1893.

Richard O. Johnson, Supt. Indiana Institute for the Education of the Deaf:

DEAR SIR: Would respectfully submit the following as the result of a trial this day of The Thurman Fuel Oil Burner Co.'s Burner, under the two (2) south boilers. Dimensions of Boilers: Shell, 66"x16'; Flues, 19-7"; Feed water temperature, 100°; Boiler pressure, 60 lbs.; Duration of trial, 8 hrs. and 15 min. 1 lb. oil consumed,—14.1 water evaporated. The combustion was perfect, and the result of the trial shows that the Burner is one of extraordinary power and highly economical, and I take pleasure in attesting to its merit. Respectfully yours,

LOUIS PRINZLER, Chief Engineer.

The Thurman Fuel Oil Burner Co., Indianapolis, Ind.:

GENTLEMEN: The above report from my trustworthy Chief Engineer, who has been in service at this institution for thirty-two years, justifies me in endorsing your device in every particular, and I trust it will meet with the approval it justly deserves. Very respectfully,

RICHARD O. JOHNSON, Superintendent.

The Electric Improvement Company, San Jose, Cal., report that we are saving them 50% in fuel over the former system of burning oil which we displaced.

The Garden City Wire & Spring Company, Chicago, report we are saving them money over coal and coke, and the heat is more uniform. We will guarantee to evaporate under modern water tube boiler, from 15 to 19 lbs. of water with one lb. of oil.

WRITE FOR CATALOGUE.

Bucyrus Steam Shovel & Dredge Co.,

—MAKERS OF—

STEAM SHOVELS — In Five Sizes for Railroad and Contract Work, Brick Yards, Stone Quarries, Stripping and Handling Iron Ore, Coal, Etc.

STEAM DREDGES — Of All Types and Sizes; for All Purposes; Elevator, Dipper, Clam Shell, Suction. Special Machines for Special Work.

WRECKING CARS — BOTH HAND AND STEAM. CAPACITIES 10 TO 35 TONS.

PILE DRIVERS — WITH EITHER DROP OR STEAM HAMMERS.

SOUTH MILWAUKEE, WIS., or BUCYRUS, OHIO.

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Am. Crusher and Am. Ball Pulverizer.

THE AMERICAN MINING & MILLING MACHINERY CO.,

29 Euclid Ave., CLEVELAND, O. 280 Caxton Blk., CHICAGO, ILL.

The Simplest, Cheapest and Best Machines in the Market. Pulverize wet or dry to any degree of fineness. Make little or no slimes in wet nor dust in dry work. Four sizes, capacity from 2 to 60 tons per day.

SEND FOR CATALOGUE.
Cable Address, American.

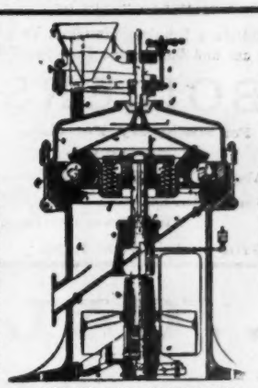
First Prize and Gold Medal Awarded by World's Fair, 1893.

Office of THE CLEVELAND IRON ORE PAINT CO. and THE GARRY IRON ROOFING CO.,
CLEVELAND, O., Jan. 25, 1894.

The American Mining & Milling Machinery Co., Cleveland, O.:

GENTLEMEN: We purchased a No. 2 American Rock Breaker and a No. 2 American Ball Pulverizer from your company about one year ago. The latter part of April, 1893, we started up for regular work, since which time we have run both of said machines to the full extent of our demands and to our entire satisfaction. The first 700 tons of hard iron ore that we pulverized for paint purposes was ground without taking the Pulverizer apart, and without expending one dollar for repairs for either of these machines. Of the 700 tons spoken of, about 200 tons was Lake Superior Specular iron ore, containing some 70 per cent. iron; a very difficult ore to pulverize. The remainder was a red fossiliferous iron ore, carrying quite a per cent. of silex, which cuts out buhr-stones rapidly. We find that the steel balls, which were when new 5 in. in diameter, now caliper 4⅞ in., and are perfectly round and smooth. The grinding track shows very little wear, and the driving track shows LESS; in fact, the wear is almost imperceptible. These two machines crush and pulverize more than one ton per hour with LESS than 12 H. P. We do not know of any Crusher or Pulverizer that can compare with the output of these two machines in quantity, quality, small amount of wear and tear, and like power. In our opinion, you cannot recommend them too highly. Very truly yours,

CLEVELAND IRON ORE PAINT CO.



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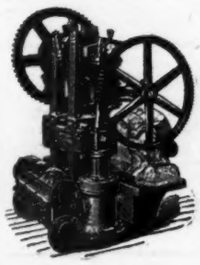
MOORE'S ANTI-FRICTION
DIFFERENTIAL
CHAIN PULLEY BLOCK

A New Movement!
A Perpetual Compound Lever!
Powerful, Simple and Durable!
Light, Compact and Strong!
One Man can Lift to the Full Capacity of the Block.
Self-Sustaining at Any Point.
The Block Always Hangs Plumb.

Moore Mfg. & Foundry Co.,
Milwaukee, Wis.



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FURNACES AND MINES, FACTORIES, ETC.

Triplex Power and Electric Pumps, Rotary Pumps, Artesian Well Steam Pumps, Hydraulic Boiler Test Pumps, etc,
MANUFACTURED BY

THE DEMING CO., Salem, O.

HENION & HUBBELL, General Western Agents, CHICAGO.

ARE YOU LOOKING
FOR A CHANGE IN LOCATION?

If you are not satisfied with your present site, or if you are not doing quite as well as you would like to, why not consider the advantages of a location on the Illinois Central R. R. or the Yazoo & Mississippi Valley R. R.? These roads run through South Dakota, Minnesota, Iowa, Wisconsin, Illinois, Indiana, Kentucky, Tennessee, Mississippi and Lousiana, and possess

FINE SITES FOR NEW MILLS,
BEST OF FREIGHT FACILITIES,
CLOSE PROXIMITY TO
COAL FIELDS AND DISTRIBUTING CENTERS
AND
INTELLIGENT HELP OF ALL KINDS,
MANY KINDS OF RAW MATERIAL.

For full information, write the undersigned for a copy of the pamphlet entitled

100 Cities and Towns **WANTING INDUSTRIES**

This will give you the population, city and county debt, death rate, assessed valuation of property, tax rate, annual shipments, raw materials, industries desired, etc.

To sound industries, which will bear investigation, substantial inducements will be given by many of the places on the lines of the Illinois Central R. R., which is the only road under one management running through from the North-Western States to the Gulf of Mexico. GEO. C. POWER, Industrial Commissioner I. C. R. R. Co., 506 Central Station, Chicago. I-2-'94.

POWER From GAS OR GASOLINE.

No Steam, Coal, Ash, Gauges, Engineer nor Danger.

From 1 to 120 horse-power. } Can be Used in City or Country.

THE OTTO GAS ENGINE WORKS,
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M. York, 42 S. Water St., Cleveland Agent.

WANTED!

We wish to purchase, for Cash, a Complete Machine and Pattern Shop equipment.

Any Firm, Assignee or Receiver who wishes to sell such an outfit, please write to us at once, giving details of Tools offered, name of manufacturer, length of time used and lowest price. We are also in the market for Boilers, Engines, Cupolas, Jib and Travelling Cranes and a Complete Electric Plant for lighting Buildings and furnishing power.

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offers **Free Factory Sites** and other inducements.

If you are seeking a new location it will pay you well to investigate the merits of our proposition.

Chicago Heights Land Association
M. H. KILGALLEN, Gen'l Mgr. CHICAGO

To Japanware Manufacturers.—A patentee is desirous of arranging with some firm or firms, to manufacture (in Japanned tinware) and sell on royalty throughout the States, a newly patented article of domestic use, which has met with great success in England. Good references will be required

MALLETT,
4 Windsor Road, SOUTHEND, ENGLAND.

LIGHT, CHEAP, COOL, DURABLE,

COLLECTS NO MOISTURE FROM UNDER SIDE. NO DRIPPINGS.

Resists acids and gases arising from inside o FOUNDRIES, IRON WORKS, MILLS, ETC.

Litho-Carbon Paint for Metal Roof sand Sidings Bridges, Smokestacks, etc., covers more space than any other Paint; dries quick, won't crack, peel or blister; will stand a heat of 550° Fahrenheit. Send for 32-page catalogue.

EMPIRE PAINT & ROOFING CO.,

111 No. Fourth St., Philadelphia, Pa.

S. FREEMAN & SONS

MFG. CO.,

11 Bridge St., RACINE, WIS.

MANUFACTURERS OF

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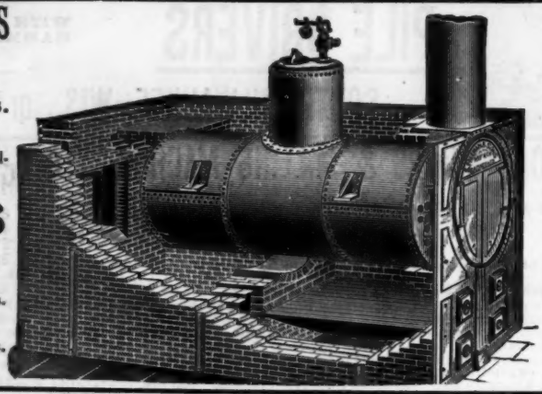

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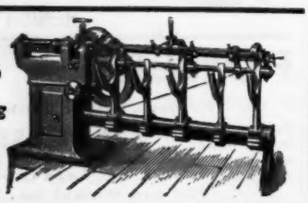

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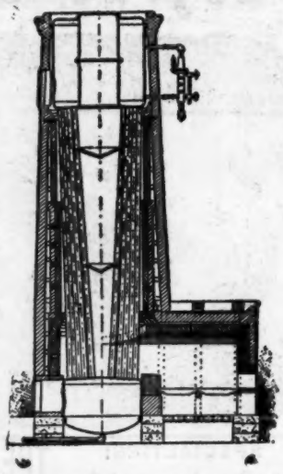

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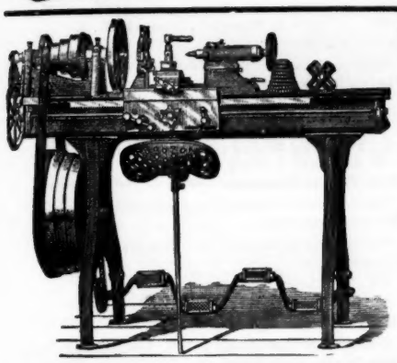

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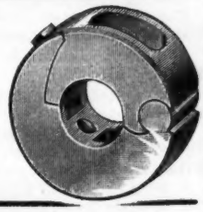

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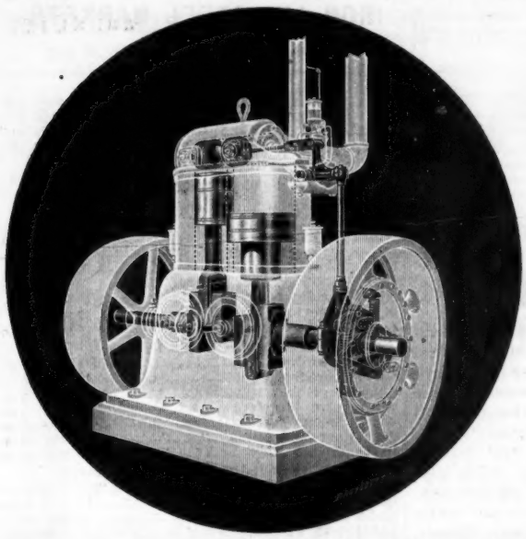

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Pulverizing Machinery—
American Mining & Milling Machinery Co., Cleveland, O.

Pumps—
Ed. Wertheim, Chicago.
Deming Co., Salem, O.

Pumps (Steam)—
Brightman Stoker Co., Cleveland, O.
Ed. Wertheim, Chicago.

Pyrometers—
Edward Brown, Philadelphia, Pa.

Radial Drills—
Bickford Drill & Tool Co., Cincinnati, O.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.
Ed. Wertheim, Chicago.

Rock Breakers—
American Mining & Machinery Co., Cleveland.

Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.
Totten & Hogg I. & S. F'dry Co., Pittsburg, Pa.

Roofing (felt)—
Consolidated Roofing Works, Columbus, O.
Empire Paint & Roofing Co., Philadelphia, Pa.

Sand and Chill Rolls—
The Lloyd-Booth Co., Youngstown, O.

Saws—
Peter Gerlach & Co., Cleveland.

Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Hendrick Mfg. Co., Ltd., Carbondale, Pa.

Scrap Iron & Steel—
Klein & Cohn, Cincinnati, O.

Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

Second-Hand Machinery—
Prentiss Tool & Supply Co., Chicago, Ill.
Hill, Clarke & Co., Chicago, Ill.
New York Machinery Depot, 178 Broadway, New York City.

Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Toledo Machine & Tool Co., Toledo, O.
Cady Mfg. Co., Cleveland, O.
Fox Machine Co., Grand Rapids, Mich.
Long & Allstatter Co., Hamilton, O.

Sheet Iron—
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Berger Bros., Philadelphia, Pa.

Smoke Consumer—
Brightman Stoker Co., Cleveland, O.

Smokeless Furnaces—
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Cady Mfg. Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Lodge & Shipley Machine Tool Co., Cincinnati.

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Gouverneur Machine Co., Gouverneur, N. Y.

Stamping and Punching—
Cady Mfg. Co., Cleveland, O.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insuranc Co., Hartford, Conn.

Steam Engines and Boilers—
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Steam Packing—
Ed. Wertheim, Chicago.
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Keasbey & Mattison Co., Ambler, Pa.
Ed. Wertheim, Chicago.
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Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O.
Vulcan Iron Works Co., Toledo, O.

Steam Specialties—
Ed. Wertheim, Chicago.
Lunkenheimer Co., Cincinnati, O.
C. H. Besly & Co., Chicago, Ill.

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Wm. Jessop & Sons, Ltd., New York, N. Y.

Steel Castings—
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Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.

Steel Stamps and Stencils—
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Brightman Stoker Co., Cleveland, O.

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S. Freeman & Sons Mfg. Co., Racine, Wis.
Enterprise Boiler Co., Youngstown, O.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

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Cleveland Twist Drill Co., Cleveland.
Manufacturers' Tool Supply Co., Chicago.
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Brightman Stoker Co., Cleveland, O.

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W. A. Crook & Bro's Co., Newark, N. J.
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Chicago Heights Land Association

M. H. KILGALLEN, Gen'l Mgr. CHICAGO

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The Chicago, Milwaukee & St. Paul Railway Company owns and operates 6,154 miles (9,900 kilometers) of railway, exclusive of second track, connecting track or sidings. The eight States traversed by the lines of the company, Illinois, Wisconsin, Northern Michigan, Iowa, Missouri, Minnesota, South Dakota, and North Dakota, possess, in addition to the advantages of raw material and proximity to markets, that which is the prime factor in the industrial success of a territory—a people who form one live and thriving community of business men, in whose midst it is safe and profitable to settle. Many towns on the line are prepared to treat very favorably with manufacturers who would locate in their vicinity.

Mines of coal, iron, copper, lead and zinc, forests of soft and hard wood, quarries, clays of all kinds, tan-bark, flax and other raw materials exist in its territory in addition to the vast agricultural resources.

A number of new factories have been induced to locate—largely through the instrumentality of this company—at towns on its lines. The central position of the States traversed by the Chicago, Milwaukee & St. Paul Railway, makes it possible to command all the markets of the United States. The trend of manufacturing is Westward. Nothing should delay enterprising manufacturers from investigating. Confidential inquiries are treated as such. The information furnished a particular industry is reliable.

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IRON ORE.

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No. 1 Specular, Bessemer	3.00@ 3.35
No. 1 Bessemer hematite	2.75@ 3.00
Hematites No. 1 non-Bessemer	2.00@ 2.50
No 1. Specular, non-Bessemer	2.35@ 3.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$10 00@$10 25
No. 1 Strong Foundry	10 75@ 11 00
No. 2 Strong Foundry	9 75@ 10 00
No. 1 Gray Forge, red short	9 10@ 9 25
No. 2 Gray Forge, neutral	9 00@ 00 00
No. 1 American Scotch	11 00@ 00 0
No. 2 American Scotch	10 00@ 00 0
Lake Superior Charcoal	13 00@ 13 50
PITTSBURG:	
No. 1 Foundry	$11 25@$11 75
No 2 Foundry	10 25@ 10 75
Gray Forge	9 10@ 9 25
White and Mottled	9 00@ 0 00
Warm Blast Charcoal	17 00@ 18 00
Cold Blast Charcoal	22 00@ 26 00
Bessemer	10 10@ 10 25
CHICAGO (reported by our representative:)	
Lake Superior Charcoal	$13 00@$13 50
Local Coke Foundry No. 1	10 25@ 10 50
Local Coke Foundry No. 2	9 75@ 10 00
Local Coke Foundry No. 3	9 40@ 9 65
Local Scotch Foundry No. 1	10 25@ 10 50
Local Scotch Foundry No. 2	9 75@ 10 00
Local Scotch Foundry No. 3	9 50@ 9 75
Southern Coke No. 1	11 00@ 11 25
Southern Coke No. 2	10 00@ 10 25
Southern Coke No. 3	9 50@ 9 75
Southern No. 1 Soft	10 00@ 10 25
Southern No. 2 Soft	9 75@ 10 00
Southern Silveries No. 1	11 50@ 11 75
Southern Silveries No. 2	11 25@ 11 50
Jackson Co Silveries	15 00@ 16 00
Ohio Silveries No. 1	14 00@ 14 50
Ohio Silveries No. 2	13 00@ 13 50
Ohio Strong Softeners	12 50@ 13 00
Alabama Car Wheel	17 50@ 18 00
Malleable Bessemer	11 00@ 11 50
Coke Bessemer	11 00@ 11 50
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$ 9 50@$10 00
Southern Coke No. 2 and No 1 Soft	9 00@ 9 25
Hanging Rock Coke, No 1	11 50@ 12 00
Hanging Rock Charcoal No. 1, Fdy	15 00@ 16 50
Tennessee Charcoal No 1	13 00@ 14 00
Jackson County Stone Coal No 1	14 00@ 14 50
Southern Coke, Gray Forge	8 25@ 8 50
" " Mottled	8 00@ 8 25
Standard Alabama Car Wheel	15 00@ 16 00
Tennessee " "	14 50@ 15 00
Lake Superior " "	13 50@ 14 00
BUFFALO (reported by Rogers, Brown & Co.)	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$11 00
No. 2 Foundry Strong Coke Iron Lake Superior Ore	10 50
Ohio Strong Softener No. 1	11 10
Jackson Co. Silvery No. 1	15 50
Lake Superior Charcoal	13 75
Southern Soft No 1	11 00
Hanging Rock Charcoal	18 50
ST. LOUIS (reported by Rogers, Brown & Meacham):	
Southern Coke No 1	$10 25@$10 00
Southern Coke No 2	9 75@ 10 00
Southern Coke No. 3	9 25@ 9 50
Southern Gray Forge	9 00@ 9 25
Southern Charcoal No. 1	14 00@ 14 50
Missouri Charcoal No 1	12 50@ 13 00
Ohio Softeners	14 00@ 14 50
Lake Superior Car Wheel	15 5 @ 16 00
Southern Car Wheel	16 00@ 6 50
Connellsville Coke, St Louis	4 40

OLD RAILS AND SCRAP METAL.

[Prices paid by mills.]

	GROSS TONS
Old iron rails	$12 50
Old steel rails	10 00
	NET TONS
No. 1 R. R wrought scrap	$ 9 00
No. 1 wrought scrap	8 00
No. 1 Machine cast scrap	8 00
Iron axles	14 50
Axle turnings	7 50
Wrought turnings (free from cast)	6 50
Cast borings	5 50
Uncut wrought iron boilers	4 00
Steel boiler plates	8 00
Grate bars	5 50
Pipes and flues (clean)	7 00
Tank iron	7 50
Hoop and band iron	6 00
Sheet iron	5 50
Wrought drillings	6 50
Malleable iron	8 00

STRUCTURAL MATERIAL.

Beams and Channels (Cleveland mill)	1.30c@1.35c
Angles	1.20c@1.25c
Tees	1.35c@1.45c
Universal Plates	1.20c
Sheared Plates	1.30c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 10
1½ to 6 by ⅜ to 1 inch	1 15
1½ to 6 by 1⅛ to 2 inch	1 30
1¼ & 1⅜ by ⅜ to ½ inch	1 15
1 & 1¼ by ⅜ to ½ inch	1 20
⅝, ¾, ⅞, by ⅜ to ½ inch	1 30

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IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

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Round and Square.

1 to 1⅞ inch	1 10
2 to 2¾ inch	1 30
2¾ to 3¾ inch	1 35
3⅞ to 4 inch	1 60
4¼ to 4½ inch	1 80
4¾ to 5 inch	2 40

Oval.

⅜ to 1¼ inch	1 30
½ to ¾ inch	1 30
⅞	1 50
⅜	1 70

Half Oval and Half Round.

1¼ to 3 inch	1 65
⅜ to 1¼ inch	1 45
½ to ¾ inch	1 70
⅞	1 85
⅜	2 95

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 20
1 to 1¾ by ¼ and 5-16 inch	1 25
¾ to ⅞ by ¼ and 5-16 inch	1 35
½ to ¾ by ¼ and 5-16 inch	1 60

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 65
1 7-16 to 2, No. 17, 18 and 19	1 70
1 7 16 to 2, No. 20	1 80
1 7-16 to 2, No. 21	1 90
1 7 16 to 2, No. 22	2 00
1⅛ to 1⅜, No. 13, 14 and 15	1 70
1⅛ to 1⅜, No. 16, 17 and 18	1 75
1⅛ to 1⅜, No 19 and 20	1 80
1⅛ to 1⅜, No. 21	1 90
1⅛ to 1⅜, No. 22	2 00
15-16 and 1 inch, No. 13, 14 and 15	1 65
15-16 and 1 inch, No. 16, 17 and 18	1 80
15-16 and 1 inch, No. 19 and 20	1 90
15-16 and 1 inch, No. 21	2 00
15-16 and 1 inch, No. 22	2 10
⅞, No. 13, 14 and 15	1 90
⅞, No. 16. 17 and 18	2 00
⅞, No. 19 and 20	2 10
⅞, No. 21	2 20
⅞, No. 22	2 30
13-16, No. 13, 14 and 15	2 00
13-16, No. 16, 17 and 18	2 10
13-16, No. 19 and 20	2 20
13-16 No. 21	2 30
13-16, No. 22	2 40
¾, No. 13, 14 and 15	2 10
¾, No. 16, 17 and 18	2 25
¾, No. 19 and 20	2 35
¾, No. 21	2 45
¾, No. 22	2 55
11-16, No. 13, 14 and 15	2 35
11-16, No. 16, 17 and 18	2 40
11-16, No. 19 and 20	2 50
1-16, No. 21	2 60
11-16, No. 22	2 70
11-16, No. 23	2 80
⅝, No. 13, 14 and 15	2 40
⅝, No. 16. 17 and 18	2 50
⅝, No. 19 and 20	2 60
⅝, No. 21	2 70
⅝, No. 22	2 80
⅝, No. 23	2 90
9-16, No. 13, 14 and 15	2 60
9-16, No. 16, 17 and 18	2 70
9-16, No. and 20	2 80
9-16, No. 21	2 90
9-16, No. 22	3 00
9-16, No. 23	3 10
7-16 and ½ inch, No. 13, 14 and 15	2 80
7-16 and ½ inch, No. 16, 17 and 18	2 90
7-16 and ½ inch, No. 19 and 20	3 00
7-16 and ½ inch, No. 21	3 10
7-16 and ½ inch, No. 22	3 20
7-16 and ½ inch, No. 23	3 30
½, No. 13, 14 and 15	3 30
½, No. 16, 17 and 18	3 40
½, No. 19 and 20	3 50
½, No. 21	4 80
½, No. 22	3 90
½, No. 23	4 05

Light Band.

1½ to 6 by ⅛ to 3-16 inch	1 40
1½ to 6 by Nos. 11 and 12	1 45
1 to 1¾ by ⅛ to 3-16 inch	1 45
1 to 1¾ by Nos. 11 and 12	1 50
⅞ and 13-16 by ⅛ to 3-16 inch	1 60
⅞ and 13-16 by Nos. 11 and 12	1 65
¾ and 11-16 by ⅛ to 3-16 inch	1 70
¾ and 11-16 by Nos. 11 and 12	1 75
⅝ and 9-16 by ⅛ to 3-16 inch	1 85
⅝ and 9-16 by Nos. 11 and 12	1 90
½ by ⅛ to 3-16 inch	2 00
½ by Nos. 11 and 12	2 05

Wagon Box Iron.

⅛ inch, beveled edge, by Nos. 11 and 12	1 60
⅛ inch, " " " " 13 and 14	1 70
¼ inch, " " " " 11 and 12	1 75
¼ inch, " " " " 13 and 14	1 05

Sheet Iron.

No. 10	1 65
No. 12	1 75
No. 14	1 80
No. 15-17	1 90
No. 18	2 05
No. 20	2 20
No. 22-24	2 30
No. 25-26	2 40
No 27	2 50

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 50
Shell	1 70
Flange	1 80
Marine Flange	2 10
Fire Box	3 00

Above includes plates 90 inches wide.

90 to 96 in. wide	⅛c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1⅛c. "
104 to 106 in. wide	special

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ROUND, SQUARE AND OCTAGON.	cts. lbs.
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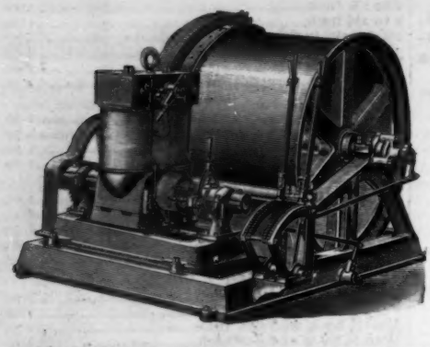
9-16 to ⅞ in. "	08½



HOISTING MACHINERY for Mining, Quarrying, Coal Handling, Pile Driving, Bridge Building, Log Hauling and for general Contractors' Use. Improved Electric Hoists, single and double Patent Friction Drum, compound, geared with brakes and reversible for general Hoisting, Mining Purposes and Suspension Cable Ways.

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Are a **necessity**; you therefore **want** the **best**, one that is **reliable, simple** and **durable**—"Lunkenheimer's" fills the bill. It has a **large** spring, **full** relieving capacity and is **very** sensitive. **Every valve warranted. Specify** and **insist** on "Lunkenheimer's." Others are using them; you should also. Keep posted. Our new Catalogue, replete with "up to date" steam specialties will interest you. Gratis upon request. Consult dealer.

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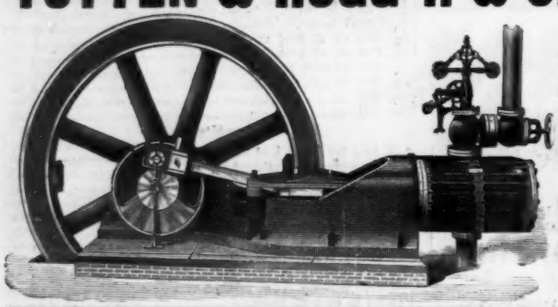
TOTTEN & HOGG I. & S. F'DRY CO.



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Chilled and Sand Rolls and Rolling Mill Machinery.

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Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**

For **22** Long and Successful years we have made our

"O.K." CROWN

OUR PRICES ARE JUST RIGHT

High Grade Fire Brick, in all shapes and sizes. They have stood the **TEST** with eminent satisfaction to our many customers, because they are made entirely on **HONOR.**

OAK HILL FIRE BRICK AND COAL CO. Manufacturers

: : : : **OAK HILL, OHIO**

7-16 to ⅜ and 2⅜ to 3 in.	.09
3⅜ to 4 in.	.09½
⅜ to 11-16 and 4⅜	.10
⅝ to 6 in.	.10½
¾ to 9-32 and 6⅝ to 7 in.	.11
16 i n	.13
3	

Flats.

	cts. lbs.
2 to 9-16 in. wide by 2 to ⅝ thick	.8

Bessemer and O. H. Steel.

Machinery	base price,	1 50
Tire	"	1 60
Spring	"	2 10
Sleigh Shoe	"	2 00
Toe Calk	"	2 05
Cutter Shoes, tapered and bent	"	2 10

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam	3 00

MACHINERY SUPPLY MARKET.

Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths' { Hill's	dis 40
Blacksmiths' { Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 4(
Standard, oak tanned	dis 50&1(
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 35
Horton's Universal	dis40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	₩ 3½
Iron, steel points	₩ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1½"	dis 50&10
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

Emery.

	No. 4 to No. 46 gr.	54 to 150 gr.	Flour, C. F F. FF.
Kegs, ₩ lb	4½c	5 c	2½c
½ kegs ₩ lb	4¾c	5¼c	2¾c
¼ kegs ₩ lb	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

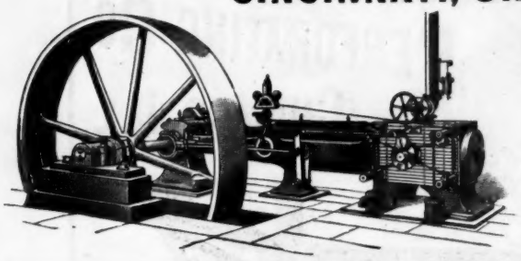
Detroit	dis 60@70
Norton's	dis 60@70
Grant	dis 60@70
Sterling	dis 60@70
Celluloid	dis 10&33⅓
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



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Will clean them better than any other method.

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Pennsylvania Lines.

Foot of Bank Street.

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* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	†12:45 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	† 3:25 pm	† 9:50 am
Hudson and Ravenna	* 5:00 pm	* 8:25 am
Philadelphia and New York	*11:10 pm	* 5:25 am
Baltimore and Washington	*11:10 pm	* 5:25 am
Alliance and Pittsburgh	*11:10 pm	* 5:25 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:40 am	* 5:15 pm
Akron and Columbus	* 8:40 am	*5:15 pm
Akron, Columbus & Zanesville	12:45 pm	*12:10 pm
Akron and Orrville	† 3:25 pm	† 9.50 am
Columbus and Cincinnati	* 8:00 pm	* 6:55 am

Saturdays the 8:00 pm train will leave at 11:20 pm.

Valley Ry.

Depot foot of So. Water St.
City Office 137 Superior St.

	Arrive.	Depart.
Akron & Canton	*6:30 P M	*7:10 A M
Akron, Canton & Valley Jctn.	*10:10 A M	*3:15 P M
Valley Jctn. & Way Stations	†6:30 P M	†7:10 A M
Akron, Canton & Chicago	*8:00 A M	*6:30 P M
Wooster and Chicago	†2:45 P M	†11:00 A M
Wooster		*6:30 P M
Akron, Canton & Marietta	†2:45 P M	†11:00 A M
Steubenville, Wheeling, Washington, D. C., and Baltimore	†2:45 P M	†11:00 A M

†Daily except Sunday. *Daily. Pullman's Palace Vestibule Drawing Room cars between Cleveland and Chicago.

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Steel Stamps and Stencils.

FLEHARTY, J. H. & Co., Rubber Stamps, Seals, Stencils, Automatic Check Punches and Numbering Machines. 92 Seneca St.

Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs	12c
" " " " over 5 lbs	10c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1.
Square	8	7	5½	4¼	4	3½	3⅛
Hexagon	15½	11½	8½	6	5¼	5¼	
Washers	9	8	7	5	4½	4¼	4⅛

In lots less than 100 lbs, ₩ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887	dis 85
Standard Penny Nails, ₩ keg card rate	
Car lots	$1.10
Less than car lots	$1.25

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz	dis 10@10&10

Packing, Steam.

Boston Belting Co	dis 60
American Packing Hemp	₩ lb 9@10
Russia " "	₩ lb 14
Italian " "	₩ lb 13@19
Plumbago Piston	₩ lb 40
Peerless	₩ lb 60
Morrison's "	₩ lb 45
Square Flax "	₩ lb 50
Sheet Rubber	₩ lb 12&24
Excelsior Rubber	₩ lb 48
Rainbow { Full Rolls	45c ₩ lb
Rainbow { Less than Full Rolls	50c ₩ lb
Eclipse Gasket	₩ lb 75

Picks.

Railroads, 5 to 6 lbs	$12 dis 60
" 6 to 7 lbs	$13 dis 60

Pulleys.

Iron Pulleys, Walker List	dis 50
Medart Pulleys	dis 50
Split Wood Pulleys	dis 55@60

Rivets.

Iron, Thousand, list November 17, 1887	dis 50&10@60
Iron, Ordinary, Cooper's Block and Carriage list November 17, 1887	dis 50&10@60
Copper	dis 50@50&10

Saws.

Disston's Circular	dis 40&10
" Band	dis 25
" Scroll	Net
Hack Saw Stubs	dis 20
" " Eureka	dis 20
" " Star	dis 20
Saw Swages Diston's	dis 30
Atkins' Circular Saws	dis 40&45
" Mill, Mulay and Drag Saws	dis 40&10
" Wood Saws	dis 40&10
" Silver Steel Diamond Cross-cut Saws	70c per ft
" Dexter Cross-cuts	50c "
" Diamond "	30c "
" Tuttle Tooth Cross-cuts	25c "
" One-man Cross-cuts	32c "
No. 1 Handles	23c per pair
No. 6 "	16c "
Excelsior Saw Tools	$6 per doz
Derfection "	$15 "
Petroit Saw Works, Circular	dis 50
" " " Band	dis 25
" " " Mulay	dis 45

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

New List, Apr. 9, 1894

Brass	dis 40
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ₩ lb dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

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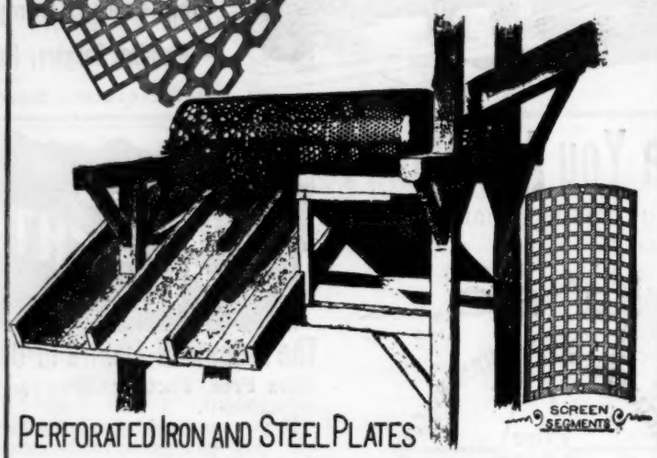

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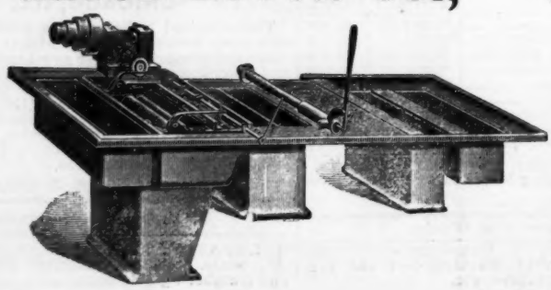

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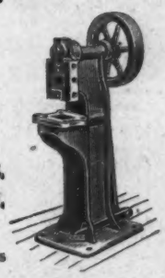

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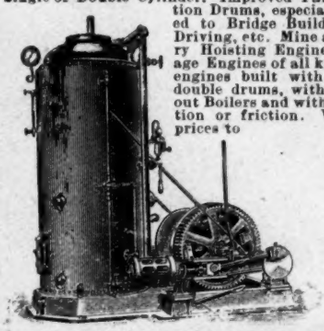

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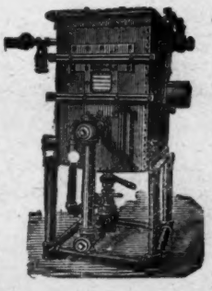

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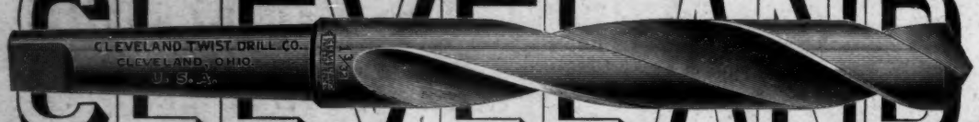

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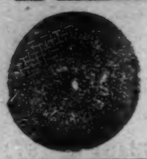

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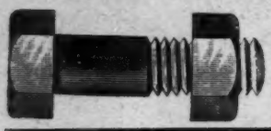

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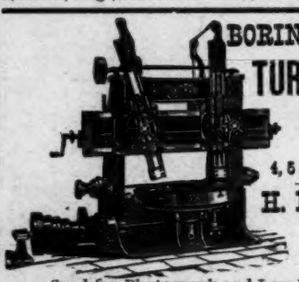

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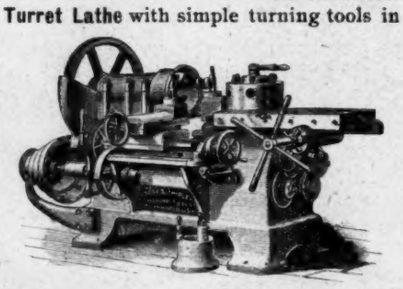

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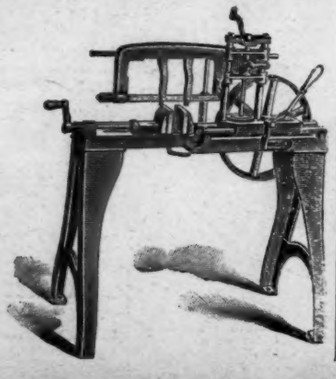

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